2006-09

Indian Nuclear command and control dilemma

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MONTEREY, CALIFORNIA

THESIS

INDIAN NUCLEAR COMMAND AND CONTROL DILEMMA

by

Rakesh Kumar

September 2006

Thesis Co-Advisors: Dan C.Boger
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REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.			
1. AGENCY USE ONLY *(Leave blank)*	**2. REPORT DATE** September 2006	**3. REPORT TYPE AND DATES COVERED** Master's Thesis	
4. TITLE AND SUBTITLE Indian Nuclear Command and Control Dilemma		**5. FUNDING NUMBERS**	
6. AUTHOR(S) Rakesh Kumar			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000		**8. PERFORMING ORGANIZATION REPORT NUMBER**	
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A		**10. SPONSORING/MONITORING AGENCY REPORT NUMBER**	
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.			
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited		**12b. DISTRIBUTION CODE**	

13. ABSTRACT (maximum 200 words)

The aim of the thesis to analyze the India's nuclear weapons command and control dilemma as a consequence of its 1998 nuclear tests. The small size of India's nuclear weapons does not imply that its command and control structure would be simple. It would require the same infrastructure, capabilities, and operating concepts possessed by countries with larger number of nuclear weapons, but maybe on a smaller scale. A small arsenal is easy to control, but then it is vulnerable to attack, and hence the issue of command and control becomes more complex. India's No-First-Use (NFU) policy and the de-mated nuclear posture also make the command and control of nuclear weapons look simple, affordable, and easy to implement. But the nuclear policy and posture must be examined through the prism of peacetime, crisis and wartime situations. The smooth transition from peacetime to crisis and, if required, to wartime demands a robust command and control system.

This thesis examines the requirements and then provides recommendations for the command and control structure for Indian nuclear operations. The thesis will investigates the U.S. command and control model and draws lessons for a suitable option for India. While NFU has many challenges, it can be effective provided that India adopts an operational capability of Launch After Attack (LAA), which would require a significant upgrade of command and control structure and procedures. In particular, this thesis demonstrates the role that civilians and military could effectively play to strengthen "minimum credible deterrence" within the established financial, political, and strategic parameters.

14. SUBJECT TERMS Nuclear command and control, nuclear weapons, civil-military relations			**15. NUMBER OF PAGES** 143
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified	**18. SECURITY CLASSIFICATION OF THIS PAGE** Unclassified	**19. SECURITY CLASSIFICATION OF ABSTRACT** Unclassified	**20. LIMITATION OF ABSTRACT** UL

NSN 7540-01-280-5500 Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18

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INDIAN NUCLEAR COMMAND AND CONTROL DILEMMA

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Lieutenant Commander, Indian Navy
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Submitted in partial fulfillment of the
requirements for the degrees of

MASTER OF SCIENCE IN SYSTEMS ENGINEERING
and
MASTER OF ARTS IN SECURITY STUDIES
(DEFENSE DECISION MAKING AND PLANNING)

from the

NAVAL POSTGRADUATE SCHOOL
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This thesis examines the requirements and then provides recommendations for the command and control structure for Indian nuclear operations. The thesis will investigates the U.S. command and control model and draws lessons for a suitable option for India. While NFU has many challenges, it can be effective provided that India adopts an operational capability of Launch After Attack (LAA), which would require a significant upgrade of command and control structure and procedures. In particular, this thesis demonstrates the role that civilians and military could effectively play to strengthen "minimum credible deterrence" within the established financial, political, and strategic parameters.

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ACKNOWLEDGMENTS

First of all I would like to thank Indian Navy for providing me an opportunity to attend Naval Postgraduate School for graduate education. Second, I would like to thank my thesis co-advisors for their enormous support and guidance. They have provided invaluable suggestions and comments from their pool of vast experience on related topics. Without their help and support this learning would not have been so edifying.

Last but not the least, I would like to express my deepest appreciation and gratitude to my wife, Reena, and son, Ronit. Their unflagging support and patience has made this work possible.

This thesis is dedicated to the soldiers, sailors and airmen of Indian Armed Forces.

Disclaimer: Opinions, conclusions, and recommendations expressed or implied within are solely those of the author and do not necessarily represent the views of Indian Navy, Ministry of Defense (India), or any other Indian government agency.

SHAN NAU VARUNA
[May the ocean God be Auspicious Unto us]

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I. INTRODUCTION

> Simple intuition suggests that omitting command parameters from consideration invites miscalculation. Such a practice is ipso facto grounds for contesting standard analytic conclusions and imposing a heavy burden of proof on them. And if the opportunity for miscalculation is as large as it seems, the much strategic enumeration is not only misleading but wrong. Command performance is quite possibly not just an important factor but the key determinant of real strategic capability…Deficiencies in command performance could be cause for serious concern regardless of the resilience of the forces and the strategy to which they are subordinated. If command and control fails, almost nothing else matters.[1]
>
> Bruce G. Blair

A. INTRODUCTION

Given the destructive potential of a nuclear weapon and the complexities involved in a nuclear employment operation, which range from establishment of nuclear doctrine based on threat, involvement of multiple organizations (political and military), contrasting control methods (technical and organizational) and huge cost implications, the command and control of nuclear weapons is a challenging and daunting task. For many years, regardless of its intrinsic significance, the nuclear command and control system has remained marginalized and the nuclear forces have taken all the attention of the analysts and policy makers. According to Bruce G. Blair, nuclear bombers, submarines, and land missiles figure prominently in debate, while the physical and procedural arrangements created to operate those forces escape notice.[2]

Between the Soviet Union and the United States, their nuclear weapons and forces were compared with respect to quantity and quality, and as a result of it there were great advancements in the quality of nuclear weapons through modernization and quantitatively the focus was on massive deployment of nuclear weapons during the Cold War. The imbalance between nuclear command and control system and the massive development and deployment of nuclear weapons can be attributed to the fact that the

[1] Bruce G. Blair, *Strategic Command and Control: Redefining the Nuclear Threat* (Washington D.C.: Brookings Institution, 1985), 3-4.

[2] Ibid., 1.

effectiveness of the nuclear command and control system cannot be ascertained with the available means, and it takes a long time to build up a formidable command and control system. On the other side, "seeing is believing" in the case of nuclear weapons and forces. Nuclear command and control is the most demanding at the time of crisis and plays a considerable role during these testing times. It did so during the crises between the Soviet Union and the United States such as Korea (1952), Vietnam (1954) and the Cuban Missile Crisis (1962). With the experience gained during each crisis, the command and control evolved toward attaining higher standards of robustness. The aftermath of the Cuban Missile Crisis forced President Kennedy to order a review of the U.S. nuclear command and control system which lead to the creation of "Football".[3]

At the heart of nuclear command and control lies the always/never dilemma.[4] The always/never problem is also associated with conventional weapons, but it is absolutely essential in the case of nuclear weapons because of their extreme destructive capabilities. The always/never dilemma spells out the recipe of a command and control system. It means that the system should always deliver whenever asked for by the authorized leader and never unless it is authorized by a competent authority. Two threats exacerbate the always/never (or positive control/negative control) dilemma: the potential for unwanted use and the potential for decapitation.[5] The civilian leader needs to allow for the problem of unwanted use, and at the same time should not cross a certain threshold so that it becomes a problem of decapitation whereby a successful first strike against his nation destroys the nuclear weapons or command and control facilities such that retaliation becomes unachievable. There is a dilemma here as there are trade-offs between positive and negative control and measures designed to improve one type of control frequently hurts the other.[6]

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[3] Federation of American Scientists, "The Football," http://fas.org/nuke/guide/usa/c3i/nuclear-football.htm [Accessed June 12, 2006]. Football is a secure briefcase that contains the information needed to enable the president to authorize and initiate a weapons strike.

[4] Peter D. Feaver, *Guarding the Guardians: Civilian Control of Nuclear Weapons in the United States* (London: Cornell University Press, 1992), 12.

[5] Peter D. Feaver, "Command and Control in Emerging Nuclear Nations," *International Security* 17, no. 3 (Winter, 1992-93): 164.

[6] Feaver, *Guarding the Guardians*, 20.

The second dilemma involved with nuclear operations is regarding the civil-military relations over the patterns associated with the control of nuclear weapons. The civilian control is dominated by two general approaches: delegative and assertive civilian control; and in both forms the military is subordinate to civilians, but the two have dramatically different conceptions of the role to be played by civilian leaders.[7] The choice of choosing a particular approach, delegative or assertive control, depends on the civil-military relations a country enjoys. The pattern of civil-military relations most nearly approximates delegative control when a strict division of labor is observed and it approximates assertive control when the traditional division of labor is violated by civilian interference in nuclear operations.[8]

Apart from the dilemmas mentioned above, Peter Feaver asserts that organizational and technological factors constitute fundamental constraints at work in the control of nuclear operations, and the five primary factors which, according to him, complicate the problem of civilian control are:

- *Normal Accidents*. No matter how effective conventional safety devices are, there is a form of accident that is inevitable as accidents are expected in complex organizations dealing with high-risk technologies due to interactive complexity and tightly coupled nature of the system of control.[9]
- *The Politics of Artifacts*. The technological artifacts, particularly those designed to resolve a specific policy problem, have long-lasting political influence, for example Permissive Action Links (PALs) where on the one hand they make tight centralized control; on the other hand they may lull political leadership into accepting deployments.
- *Balloon Effect*. As squeezing a balloon displaces but does not reduce the air contained in the balloon, similarly civilian assertion in one area is likely to squeeze military autonomy into different areas, but it will not necessarily reduce overall military autonomy.
- *The Paradox of Control*. Efforts at control often produce subordinate behavior that deviates to a greater extent from desired behavior than might have been the case in the absence of such efforts.

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[7] Feaver, *Guarding the Guardians*, 7.

[8] Ibid., 10-11.

[9] Charles Perrow, *Normal Accidents: Living with High-Risk Technologies* (New York: Basic Books, 1984), 3-4.

- *The Inevitability of Unwritten Rules and "Work-Arounds"*. No written procedures, however well crafted,[10] can anticipate every circumstance under which the system must operate.

B. BACKGROUND OF THE PROBLEM

India encountered the nuclear weapons command and control dilemma as a consequence of the 1998 nuclear tests by New Delhi. All the dilemmas and constraints mentioned earlier are applicable to New Delhi's quest for restructuring India's nuclear command and control system. As a responsible nuclear state, India took the first significant step toward establishment of a nuclear command and control system by promulgating a draft nuclear doctrine,[11] on August 17, 1999 and releasing it to the public for open debate. After a considerable debate on the policy issues, the Cabinet Committee on Security (CCS) accepted the draft nuclear doctrine and announced the establishment of the Political Council chaired by the Prime Minister and the Executive Council chaired by the National Security Advisor.[12] The broad guidelines regarding development, deployment and employment of Indian nuclear forces are stipulated in the draft nuclear doctrine and there is an ongoing debate about the possible paths which India should adopt in fulfilling these guidelines. India has not made any official statement regarding the status and implementation of the draft nuclear doctrine except that it has been accepted by the CCS on January 4, 2003. In this regard it is presumed that Indian government is maintaining a fine balance between transparency and opacity. The government also needs to consider that a degree of opacity strengthens the deterrent, but the complete lack of transparency could lead to serious misperceptions and miscalculation.[13]

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[10] Charles Perrow, *Normal Accidents: Living with High-Risk Technologies* (New York: Basic Books, 1984), 22-26.

[11] Embassy of India, "Draft report of National Security Advisory Board on Indian Nuclear Doctrine," http://www.indianembassy.org/policy/CTBT/nuclear_doctrine_aug_17_1999.html [Accessed April 23, 2006].

[12] Government of India Press Information Bureau, "Cabinet Committee on Security Reviews Progress in Operationalizing India's Nuclear Doctrine," (Press Releases, Prime Minister's Office, Jan 4, 2003), http://pib.nic.in/archieve/lreleng/lyr2003/rjan2003/04012003/r040120033.html [Accessed May 23, 2006].

[13] P. R. Chari, "Nuclear Restraint, Nuclear Risk Reduction, and the Security-Insecurity Paradox in South Asia," *The Henry L. Stimson Center*, June 2001, http://www.stimson.org/southasia/pdf/NRRMChari.pdf [Accessed June 12, 2006].

Another important aspect is that the small number of Indian nuclear weapons does not imply that the corresponding command and control structure would be simple. It would require the same infrastructure, capabilities and operating concepts as countries possessing larger numbers of nuclear weapons, but on a smaller scale, and of course a lot depends on the selected Indian nuclear posture. The small number of weapons is easy to control, but then they are vulnerable with respect to survivability and hence the issue of command and control becomes more complex. The No-First-Use (NFU) policy mentioned in the Indian nuclear doctrine states that the nuclear weapons will only be used in retaliation against a nuclear attack on Indian Territory or on Indian forces anywhere. The No-First-Use policy by India may make the command and control of nuclear weapons look simpler, affordable and easier to implement. But the No-First-Use policy has to be looked at through the prism of peacetime, crisis and wartime situations. The military crises with nuclear-armed Pakistan have been a regular feature in the Indian subcontinent in the past two decades. Managing these military crises in order to avoid nuclear brinkmanship, which could lead to a catastrophic disaster, is absolutely essential in South Asia. The swift handover or the smooth transition from peacetime to crisis and, if required, to a wartime situation would require a robust command and control system.

To add to the complexities of Indian nuclear command and control, New Delhi needs to allow for two of its nuclear armed neighbors, China and Pakistan. Unlike the Cold War of the superpowers where they were pitted against each other, the Asian Cold War is arguably based on Kautilaya's principle of "enemy's enemy is a friend". The development of an Indian nuclear command and control system should allow for an advanced nuclear and ballistic missile capable China, and at the same time should not inject unnecessary fear in a lesser capable Pakistan. Given the situation in South Asia, a triangular or bilateral treaty obligation involving China, India and Pakistan would be very difficult to negotiate since neither equality nor formalized inequality is likely to be acceptable to one or more parties.[14] Therefore a multilateral treaty involving China, India and Pakistan on No-First-Use seems impossible. India is a peace-loving nation and has

[14] Micheal Krepon, "Nuclear Risk Reduction: Is Cold War Experience Applicable to South Asia?" *The Henry L. Stimson Center*, June 2001, http://www.stimson.org/southasia/pdf/NRRMKrepon.pdf [Accessed July 5, 2006].

always renounced nuclear weapons but, owing to its precarious security problems, it was forced to develop nuclear weapons. The solution to its strategic security predicament lies in the nuclear command and control system. The NFU is unlikely to be dropped by New Delhi and therefore the Indian command and control system needs to balance between credible deterrence and moralistic NFU. Apart from the political and organizational challenges, India faces the technical and financial challenges as well towards developing, deploying and maintaining a robust command and control system.

C. SUMMARY OF THE LITERATURE

The thesis examines two sets of literature that are relevant to the understanding of command and control of nuclear weapons in India. The first set of literature will be India-specific, where the various issues of command and control of nuclear weapons will be considered and examined. The second body of literature is used to study the command and control of nuclear weapons of the United States.

The Indian nuclear doctrine, strategy, force posture and command and control of nuclear weapons have been reviewed by many well-known Indian and international scholars. The key issues with regards to the Indian nuclear doctrine as summarized by Dinesh Mannan are the viability of No-First-Use in the Indian context, the credibility of deterrence, survivability concerns after first strike, lack of C4I2 infrastructure and the safety and security apprehensions of nuclear assets.[15] In addition, it is debated that the force posture demonstrated is not commensurate with the threat perceived as India still does not possess the strike capability to target the entire Chinese territory. A nuclear submarine capable of launching SLBMs would enhance India's strike capability but is still in the developmental stage.[16] In the field of C4I2 systems and the space-based assets which have been envisaged in the nuclear doctrine to provide early warning, communication and damage assessment, much still needs to be done to accomplish a

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[15] Dinesh Mannan, "A study of the Indian National Command Authority," *Bharat Rakshak Monitor* 6(2), (September – October 2003), http://www.bharat-rakshak.com/MONITOR/ISSUE6-2/dinesh.html [Accessed 15 March 06].

[16] GlobalSecurity.org, "Advanced Technology Vessel (ATV)," http://www.globalsecurity.org/military/world/india/atv.htm [Accessed April 15, 2006].

foolproof command and control system, though India has made certain progress in this direction.

The most notable books debating the various facets of command and control of the nuclear arsenal in India are *Nuclear Defense, Shaping the Arsenal* by Colonel Gurmeet Kanwal,[17] and *A Nuclear Strategy for India* by RADM Raja Menon.[18] Kanwal's book gives a detailed account of a full scale critical analysis of the nuclear force structure that India should build for a credible nuclear deterrence. As a military officer, he provides insight into nuclear strategy, targeting philosophy, force structure and command and control. He argues that the No-First-Use is a major debate in India, and according to him this policy is a well-thought option for stability in South Asia. He looks at the important aspects of command and control of other nuclear weapon states and recommends a nuclear command and control structure for India whilst abiding by the No-First-Use and minimum credible deterrent policies. Menon's book outlines deterrence theory, which is an important function in determining the command and control structure. In the later part of the book the author provides a workable model for planning a force and for organizing a nuclear command and control system. The author throws light on establishment of DEFCONs (defense conditions), availability of early warning systems, robust communication systems and a seamless chain of command for an effective command and control of nuclear weapons.

India's Emerging Nuclear Posture by Ashley J. Tellis deals with the emerging nuclear posture of India, her strategic interests and security goals. The technical details of the nuclear arsenal have been voluminously covered in two chapters named "Toward a Force-in being". These three books cover all the important aspects of command and control of nuclear weapons in India and they will provide the necessary foundation for the existing command and control organization of nuclear weapons in India.

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[17] Gurmeet Kanwal, *Nuclear Defense, Shaping the Arsenal* (New Delhi: The Institute for Defense Studies and Analysis, 2001), 143-169.

[18] Raja Menon, *A Nuclear Strategy for India* (New Delhi: United Services Institution of India, 2000), 235-283.

The literature for the comparative study of command and control of nuclear weapons by the United States will provide the essential prerequisites for managing a nuclear operation.

Managing Nuclear Operations, by A. B. Carter, J. D. Steinbruner and C.A. Zraket, gives a detailed account of managing nuclear operations by the United States during peacetime and crisis, the command system required to conduct these operations, and dwells upon management issues.[19] For the command system the book examines the communication needs of strategic nuclear forces, the warning and assessment sensors, the command center functions and the delegation of nuclear command authority.

C3 Nuclear Command Control and Cooperation, by Valery E Yarynich discusses the command and control systems of Russia and the U.S. in great depth and provides comparative analysis of command and control structures and the procedures followed by these two countries.

Strategic Command and Control, Redefining the Nuclear Threat, by Bruce G Blair, explains the central issue with nuclear weapons is command and control. It provides an account of the U.S. nuclear control system as it has evolved over the years.[20] The vulnerability of command, control and communication is an important issue, and he argues that lack of a robust system in the United States could invite a pre-emptive Soviet strike and also degrade an effective retaliatory strike.

The book, *Guarding the Guardians: Civilian Control of Nuclear Weapons in United States*, by Peter D. Feaver examines the evolution of U.S. policy on the custody of nuclear weapons with respect to physical and legitimate control. It provides a detailed account of problems associated in ensuring continuous civilian control over nuclear operations.

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[19] Ashton B. Carter, John D. Steinbruner and Charles A. Zraket, *Managing Nuclear Operations* (Washington D.C.: Brookings Institution, 1987), 17-425.

[20] Blair, *Strategic Command*, 1-303.

D. PURPOSE AND SCOPE OF STUDY

The management of nuclear weapons is laid on always/never guidelines and this balancing act is indispensable knowing the enormous destructive power of nuclear weapons. Therefore it is essential for a responsible nuclear state like India to strive for a perfect always/never nuclear posture depending on the threat perceived. The strategic stability in the region is crucial as India borders two other nuclear weapon states that have fought conventional wars with India in the past. Another important concern involving nuclear weapons is the maintenance of the highest standards of safety and security of the arsenal, which can only be made possible with an infallible command and control system. Adherence to these requirements mentioned above is absolutely essential, and the nuclear strategists in India are engaged in solving the puzzle of development, deployment and employment of the nuclear forces.

The purpose of this thesis is to design a robust command and control system for India which demonstrates credible deterrence, and is essentially based on the Indian pledge of NFU. It will do so by analyzing the requirements of Indian nuclear strategy, studying the U.S. nuclear command and control system as a model and, based on the model, deduce certain essential elements required to construct an Indian nuclear command and control system whilst adhering to the draft nuclear doctrine of India.

The thesis does not dwell upon nuclear targeting which, though is a constituent of nuclear operation, is beyond the purview of this study. It is also beyond the scope of this thesis to analyze the number of nuclear weapons required to maintain the strategic balance. It is assumed that adequate measures would be taken and a sufficient number of nuclear weapons will be available for retaliation.

E. ORGANIZATION OF THE THESIS

The thesis first introduces the topic and the background of the problem. It then dwells upon the Indian nuclear policies and strategies as enumerated in the Indian nuclear doctrine. It discusses the threat perceived and the command and control structure in place to manage and operate these weapons of mass destruction. On completion of this examination of threat perception, force posture and command and control structure, the thesis points out shortcomings and limitations in these areas. The later part of the thesis

investigates the command and control set up of the United States in managing their nuclear arsenal. It is opined that through the comprehensive study of the model, necessary information would be gathered about the prerequisites of a nuclear operation. Based on this information, an Indian nuclear command and control system would be structured to meet the challenging demands of the draft nuclear doctrine. It concludes with a summary of findings and a roadmap for a robust Indian nuclear command and control system. Figure 1 shows the outline of the thesis.

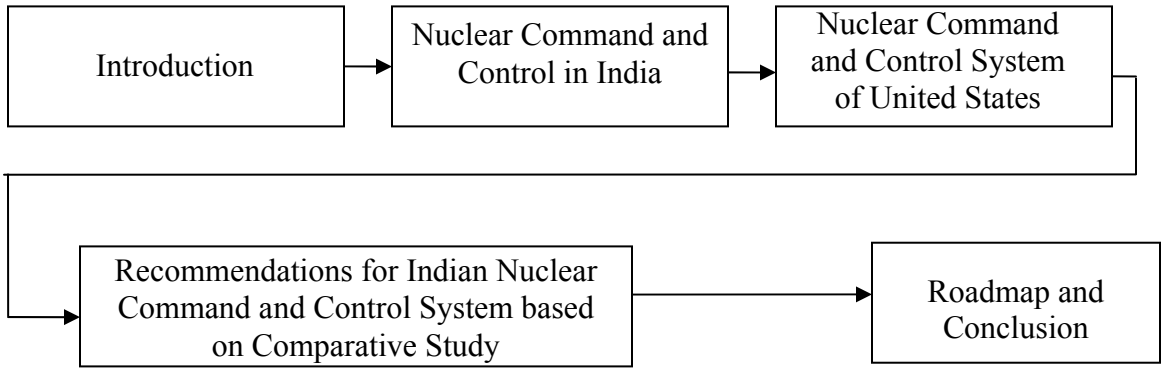

Figure 1. Roadmap of the Thesis

II. INDIAN NUCLEAR COMMAND AND CONTROL SYSTEM

> India is now a nuclear weapon state. This is a reality that cannot be denied. It is not a conferment that we seek; nor is it a status for others to grant. It is an endowment to the nation by our scientists and engineers…We do not intend to use these weapons for aggression or for mounting threats against any country; these are weapons for self-defense, to ensure that India is not subject to nuclear threats or coercion.[21]
>
> Prime Minster Atal Bihari Vajpayee

A. INTRODUCTION

India became a nuclear weapon state after testing five nuclear devices during May 11-13, 1998, in the Pokhran range. The self-imposed restraint by India for 24 years, after having first demonstrated nuclear capability in 1974, is unique in the world and displays India's constant abhorrence to nuclear weapons. The rationale behind the test can be ascertained from the letter by Vajpayee to President Bill Clinton following India's nuclear tests in May 1998. Vajpayee wrote:

> I have been deeply concerned at the deteriorating security environment, specially the nuclear environment faced by India for some years past. We have an overt nuclear weapon state on our borders, a state which committed armed aggression against India in 1962. Although our relations with that country have improved in the last decade or so, an atmosphere of distrust persists mainly due to the unresolved border problem. To add to the distrust that country has materially helped another neighbor of ours to become a covert nuclear weapons state. At the hands of this bitter neighbor we have suffered three aggressions in the last 50 years.[22]

The development of nuclear weapons in India has taken decades and involved many governments. The bomb has many fathers: Congress conceived it, the United Front nurtured it, and the BJP delivered it.[23] But the non-weaponized nuclear deterrent posture adopted by India during the 80s and 90s did not ask for promulgation of nuclear doctrine.

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[21] "Suo Motu Statement by Prime Minister Atal Bihari Vajpayee in the Indian Parliament on May 27, 1998," *India News*, May 16-June 15, 1998, 1.

[22] "India's Letter to Clinton on Nuclear Testing," *New York Times*, May 13, 1998.

[23] A. S. Prakash, "All Were Party to the Nuclear Gatecrash," *The Pioneer* (Chandigarh), May 25, 1998.

Consequently, after the 1998 tests, the BJP government released Draft Nuclear Doctrine (DND) which posits the nuclear policies and posture of India and lays the guidelines for nuclear command and control in India.

This chapter will shed light on the DND and existing nuclear command and control system in India. It will look into the threat perceived by India and the force posture maintained to mitigate this threat. Later, it will dwell upon the limitations of the existing command and control system in India.

B. INDIAN NUCLEAR DOCTRINE

The draft Indian nuclear doctrine and command and control of nuclear weapons were first documented by the National Security Advisory Board (NSAB) on August 17, 1999.[24] Subsequently, the Cabinet committee on Security on January 4, 2003, summarized,[25] the salient features of the draft doctrine as follows:

- Building and maintaining a credible minimum deterrent.
- Policy of "No First Use" (NFU): nuclear weapons will only be used in retaliation against a nuclear attack on Indian Territory or on Indian forces anywhere.
- Nuclear retaliation to a first strike by the opponent will be massive and designed to inflict unacceptable damage.
- Nuclear retaliatory attacks can only be authorized by the civilian political leadership through the NCA.
- Non-use of nuclear weapons against non-nuclear weapon states.
- In the event of a major attack against India, or Indian forces anywhere, by biological or chemical weapons, India retains the option of retaliating with nuclear weapons.
- A continuance of strict controls on export of nuclear and missile related materials and technologies, participation in the Fissile Material Cutoff Treaty negotiations, and continued observance of the moratorium on nuclear tests.
- Continued commitment to the goal of a nuclear weapon free world, through global, verifiable and non-discriminatory nuclear disarmament.

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[24] Arms Control Association, "India's Draft Nuclear Doctrine," http://www.armscontrol.org/act/1999_07-08/ffja99.asp [Accessed December 20, 2005].

[25] Prime Minister's Office Press Releases, "Cabinet Committee on security Reviews Progress in Operationalizing India's Nuclear Doctrine," http://pib.nic.in/archieve/lreleng/lyr2003/rjan2003/04012003/r040120033.html [Accessed May 31, 2006].

C. THREAT PERCEPTION

The threat perception is an important ingredient in determining the command and control system. The threat perceived by the United States during the Cold War ensured a massive expansion of nuclear weapons and the introduction of an elaborate and complex command and control system to support nuclear operations. India has two nuclear armed neighbors, China and Pakistan, with whom it has fought conventional wars in the past. The Chinese and Pakistani threats in the 1980s and 1990s may have crystallized into demonstration of nuclear tests by New Delhi. India and the world are well aware of the non-proliferation set-back in the 1980s and 1990s as a result of clandestine assistance by China in the nuclear program of Pakistan, and this nexus continues to be a menace to India. India therefore finds itself in a precarious situation where it is threatened by two nuclear armed states which have common strategic interests. During the Cold War, because of the two main players, there was a kind of strategic stability; but in a triangular affair between India, China and Pakistan the strategic instability is bound to creep in. The nuclear doctrine, policy and posture of India then essentially depend upon the relations of India with China and Pakistan.

1. China

China is a regional Asian power which dominates the region economically and militarily and aspires to dominate world affairs in the near future. China has taken giant steps on both the economic and military fronts in the recent past. The technological advancements and sustained two figure growth in GDP has provided the necessary impetus for defense modernization in China. China is an expansionist and ambitious country which will try to suppress any other country which it sees as a potential challenger to its aspirations. China views India as a potential challenger to its economy and military and will do everything on its part to contain India. This is being carried out by continuously claiming Indian Territory without any rational foundation and assisting Pakistan in improving its nuclear and missile capabilities to counterbalance India's military power. In addition to occupying large tracts of Indian Territory, China rejects Indian sovereignty over Sikkim, and lays claim to the whole of Arunachal Pradesh up to

the Brahmaputra River in the Assam plains.[26] On the other hand, China has peacefully resolved almost all other border disputes with its other neighboring countries (except India), having concluded treaties that limit 20,222 Km of its boundaries.[27] This is because of the economic interests of China in its neighboring countries, other than India, weighs more as these countries do not pose a challenge to Chinese military power. Whereas in the Indian context, the Chinese want to prolong the border issues and constantly engage the Indian militarily. This is despite the fact that India wants to resolve all outstanding issues with China peacefully. During his visit to China in June 2003, Vajpayee reiterated its recognition of Tibet as part of China and promised not to support separatist activities by Tibetan exiles in India.[28] Any border dispute with China could lead to a nuclear war and it may be one of the reasons of massive deployment of Chinese nuclear armed missiles around borders adjoining India.

The relations with India, with whom China enjoyed excellent rapport with Prime Minister Jawaharlal Nehru's Five Principles of Peaceful Co-existence after India's independence, were marred by the Chinese invasion in 1962. It carved an irreconcilable security concern on the Indian psyche and was corroborated by the Chinese nuclear tests in 1964. Over a period of three decades between 1964 and 1996, China conducted 45 nuclear tests, of which 23 were atmospheric.[29] China continues to modernize its nuclear arsenal. China has declared the NFU policy, but this policy has been challenged by many analysts. According to Vijai K. Nair, China's nuclear doctrine includes the use of nuclear weapons to settle territorial disputes and its 'no-first-use' strategy is directed only toward non-nuclear weapon states, a group from which India was excluded well before May 1998.[30]

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[26] Vijai K. Nair, "No More Ambiguity: India's Nuclear Policy," *Foreign Service Journal* (October 2002): 51.

[27] Fu Ying, "China and Asia in the New Period," *Foreign Affairs Journal*, no. 69 (September 2003): 1.

[28] David Shambaugh, "China Engages Asia, Reshaping the Regional Order," *International Security* 29, no.3 (Winter 2004-05): 82.

[29] "India's Statement on Chinese Reaction to Nuclear Tests," *India News*, May 16-June 15, 1998, 6.

[30] Nair, "No More Ambiguity," 51.

The Chinese nuclear arsenal is nowhere close to that of the United States and Russia, two potential adversaries; however, China has resources and technological capabilities to enhance their nuclear program. But the Chinese have not expanded their nuclear capabilities to either match the United States or Russia; instead they have kept a low profile by promulgating NFU policy. There could be many reasons for maintaining a low profile. First, the Chinese strategic security does not warrant an offensive nuclear policy but certainly an offensive nuclear posture is maintained in the form of deployed nuclear and conventional missiles. Second, their nuclear weapons expansion program will unnecessarily create panic in the region, especially for Japan who might have to rethink its strategic security. Third, with a low profile, China is buying the necessary time to modernize its missiles, nuclear weapons capabilities and space technologies. The Chinese nuclear and missile technology proliferation to Pakistan is a nuisance to India. With the proliferation, and later Pakistan having demonstrated nuclear and missile capabilities, there seems to be lull in military ties between these two countries, though economic cooperation between China and Pakistan has increased tremendously. The lull in military ties can be attributed to the fact that China has accomplished its goal of balancing India and such clandestine assistance is a setback to the proliferation regime which disrupts the Chinese image as a responsible nuclear state. However it is most likely that China will again resort to clandestine transfer of technology to Pakistan once India attains the capability of operating SLBMs on nuclear submarines. This way, by clandestinely helping Pakistan, China has found an easy but harmful and dangerous solution to India's growing military and economic power in the region. India, being a responsible nuclear state, would not have visualized about a stalemate by sharing its nuclear and missile technology with Japan. But it would be in the interests of India to at least share the common strategic concerns with Japan.

a. China's Nuclear Arsenal

The Chinese strategic posture has been less transparent when compared to the West. China has never disclosed the size and disposition of its nuclear forces, though it is estimated that it is third in terms of quantity of nuclear weapons after the United States and Russia. According to an estimate, in 2006 China deploys approximately 130 nuclear warheads for delivery by land-based missiles, sea-based missiles and bombers

and additional warheads to be in storage, for a total stockpile of approximately 200 warheads.[31] The estimates of the Chinese nuclear warheads by the same authors in 2003 were 400.[32] These estimates indicate that there is a decline in the number of Chinese warheads. The basis for the decline in estimates has not been declared as all these estimates are based on current intelligence inputs.

The modernization of the nuclear arsenal in China is underway. China conducted a series of nuclear tests in the 1980s and 1990s. Although China officially declared in 1994 that these tests were for improving safety features on existing warheads, these tests were also likely intended for the development of new, smaller warheads for China's next-generation solid-fuel ICBMs DF-31 and DF-41 and also possibly to develop a Multiple Independently targeted Reentry Vehicle (MIRV) capability.[33]

b. China's Nuclear Delivery Systems

China maintains the nuclear weapon delivery capabilities of a triad (i.e., land based missiles, submarine launched ballistic missiles and bombers). Like the Russians, the Chinese have the land based missiles as their strongest leg. The current nuclear delivery systems and the future inductions with their Initial Operating Capabilities (IOC) are mentioned below:

- The People's Liberation Army (PLA) Second Artillery is fielding mobile, more survivable missiles capable of targeting the United States, Japan, India, Russia, and other targets in Asia and the rest of the world. It currently deploys approximately 20 silo-based, liquid-fueled CSS-4 ICBMs, which constitute its primary nuclear means of holding continental U.S. targets at risk. In addition, it maintains approximately 20 liquid-fueled, limited range CSS-3 ICBMs that enable it to attack targets in Asia region. China's "theater" nuclear force is made up of the CSS-2 IRBMs and solid propellant, road-mobile CSS-5 MRBMs.
- By 2010, China's strategic nuclear forces will likely comprise a combination of enhanced silo-based CSS-4 ICBMs; CSS-3 ICBMs; CSS-5 MRBMs; soild-fuled, road mobile DF-31 (IOC in 2006) and DF-31A

[31] Robert S. Norris and Hans M. Kristesen, "NRDC: Nuclear Notebook Chinese Nuclear forces, 2006," *Bulletin of the Atomic Scientists* 62, no.3 (May-June 2006): 60-63.

[32] Robert S. Norris and Hans M. Kristesen, "NRDC: Nuclear Notebook Chinese Nuclear forces, 2003," *Bulletin of the Atomic Scientists* 59, no.6 (November-December 2003): 77-80.

[33] NTI, "China's Nuclear Weapon Development, Modernization and Testing," http://www.nti.org/db/china/wnwmdat.htm [Accessed July 20, 2006].

ICBMs (IOC 2007); and sea-based JL-1 and JL-2s SLBMs (IOC 2007-10). The JL-2 SLBMs will be deployed onboard the JIN-class (Type 094) SSBN.[34]

The Chinese arsenal along with their delivery systems is shown in Table 1. In view of the inaccuracies in the estimates of the Chinese nuclear forces, Table 1 has been compiled from three resources in order to narrow down the inaccuracies.

Type	NATO Designation	Number	Year Deployed	Estimate Range (Km)	Warhead X Yield (KiloTons)
Land-based Missiles					
DF-3A	CSS-2 IRBM	14-18	1971	2790+	1 x 3300
DF-4	CSS-3 ICBM	20-24	1980	5470+	1 x 3300
DF-5A	CSS-4 ICBM	20	1981	13000+	1 x 4000-5000
DF-21,21A	CSS-5 Mod 1/2 MRBM	19-50	1991	1770+	1 x 200-300
DF-15/M-9	CSS-6 SRBM	275-315	?	600	1 x 50-350
DF-11/M11	CSS-7 SRBM	435-475	?	300	1 x 350
DF 31	CSS-X-17	0	Under Development	8000+	1 x?
DF 31A	?	0	Under Development	12000+	1 x?
Sea- based Missiles					
JL-1	CSS-NX-3 SLBM	12	1986	1770+	1x 200-300
JL-2	CSS-NX-4 SLBM	0	Under Development	8000+	1 X?
Nuclear capable Aircraft					
Hong-6	B-6	120	1965	3100	1-3 X 10-3000
Qian-5 etc	A-5A	?	1970	400	1 X 10-3000

Table 1. Chinese Nuclear Arsenal and Delivery Platforms[35]

[34] Office of the Secretary of Defense, "Military Power of the People's Republic of China 2006," Annual Report to Congress, 26-27.

[35] Compiled from Office of the Secretary of Defense, "Military Power,"; Norris and Kristesen, "NRDC,"; and Nuclear Threat Initiative, "Nuclear Capabilities," China Profile, http://www.nti.org/e_research/profiles/China/Nuclear/5569_5636.html [Accessed on May 21, 2006].

Additional information on the Chinese nuclear forces is mentioned below:

- JL-1 has never been fully operational. It is the sea-based variant of DF 21/21A. JL-2 is a variant of DF-31 missiles.
- China's Second Artillery maintains at least five operational SRBM brigades; another brigade is deployed with the PLA ground forces garrisoned in Nanjing military region.
- Tactical warheads (possibly including artillery shells, rockets, Atomic Demolition Munitions (ADMs) which have low Kilo Ton yield amount to 70 warheads.
- Standard abbreviations:
  - DF- Dong Feng (East Wind).
  - JL- Julang (Giant Wave).
  - CSS- Chinese Surface to Surface.
  - CSS-N- Chinese Surface to Surface Naval.
  - CSS-T- Chinese Surface to Surface Tactica.l[36]

2. Pakistan

India and Pakistan have had unstable relations since their independence in 1947. Since then the two countries have fought three wars in 1947-48, 1965, 1971 and one limited war in 1999 (Kargil conflict). The Kargil conflict was fought after the two countries had demonstrated their nuclear capabilities in May 1998. The overt nuclear capability of Pakistan did not provide it to overcome the unnecessary paranoia of the Indian military. New Delhi hoped that Pakistan would no longer be concerned with the strategic asymmetry that had long prevailed in India's favor.[37] Instead the Kargil conflict in 1999 proved that Indian assumptions were misplaced. The conclusion drawn in New Delhi from the Kargil experience was that, instead of seeking a stable relationship on the basis of nuclear weapons capabilities, Pakistan used nuclear deterrence to support aggression.[38]

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[36] Office of the Secretary of Defense, "Military Power,"; Norris and Kristesen, "NRDC,"; and Nuclear Threat Initiative, "Nuclear Capabilities," China Profile, http://www.nti.org/e_research/profiles/China/Nuclear/5569_5636.html [Accessed on May 21, 2006].

[37] V. R. Raghvan, "Limited War and Nuclear Escalation in South Asia," *The Nonproliferation Review* (Fall-Winter 2001):2.

[38] Raghvan, "Limited War."

Pakistani leaders undertook the Kargil operation based in part upon their belief that Pakistan enjoyed a local tactical advantage over India, and that Pakistan would receive international support for its position in the confrontation.[39] The Kargil conflict has forced the Indian strategists to rethink their war doctrine. The Indian caution [during the Kargil conflict] resulted at least in part from concern over the possibility of a Pakistani nuclear response.[40] In order to refrain from carrying out another Kargil-like adventure, the Indian strategists have carved out the strategy of "limited war" with Pakistan. Former Indian Army Chief of Staff General V P Malik states that, "if Pakistan could do Kargil [without escalation to the strategic level], India could do something similar in response to the continued Pakistani's provocation in Kashmir without fear of a nuclear confrontation."[41]

General Khalid Kidwai of Strategic Plans Division (SPD) asserts that "nuclear weapons are aimed solely at India and in case the deterrence fails, they will be used if:

- India attacks Pakistan and conquers a large part of its territory (space threshold).
- India destroys a large part either of its land or air forces (military threshold).
- India proceeds to the economic strangling of Pakistan (economic strangling).
- India pushes Pakistan into political destabilization or creates a large subversion in Pakistan (domestic destabilization)."[42]

Kashmir remains an issue between India and Pakistan. A large tract of land in Kashmir has been illegally occupied by Pakistan despite the whole territory of Jammu and Kashmir being an integral part of India after the maharaja of Kashmir signed an instrument of accession and joined India in 1947. In a secular democracy, the legal

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[39] S. Paul Kapur, "India and Pakistan's Unstable Peace: Why Nuclear South Asia Is Not Like Cold War Europe," *International Security* 30, no. 2 (Fall 2005):144.

[40] P. R. Chari, P.I. Cheema and Stephen P. Cohen, *Perception, Politics, and Security in South Asia: The Compound Crisis of 1990* (London: Routledge Curzon, 2003), 143.

[41] Kapur, "India and Pakistan's Unstable Peace," 148.

[42] Lanau Network- Centro Volta, "Nuclear Safety, Nuclear Stability and Nuclear Strategy in Pakistan," http://lxmi.mi.infn.it/~landnet/Doc/pakistan.pdf#search=%22nuclear%20safety%2C%20nuclear%20stability%20and%20nuclear%20strategy%22 [Accessed on July 18, 2006].

aspects are more significant and binding than the rational thinking of self-determination. It can be argued that the legal accession of California and parts of Texas with the United States has prevented Mexico from claiming these territories though they were part of Mexico before their accession. But Pakistan fails to recognize the legal accession of Kashmir with India. The support for terrorists and the eventual "liberation" of Indian Kashmir is a central national project,[43] and the Kashmir dispute, in the Pakistani government's view, constitutes the "core issue" in Indo-Pakistani relations.[44] But is Kashmir the "core issue" between India and Pakistan? The answer is no. Pakistan is a nation which is born insecure and the question raised by the prosperity of Muslims who remained in a democratic and secular India vis-à-vis the Muslims in Pakistan always haunts the political leaders of Pakistan and questions its very existence. The same political leaders, when they are out of power, would criticize the foreign policies of Pakistan and would suggest peaceful solutions to all the disputes with India. A recent statement by former Prime Minster Nawaz Sharrif and Benazir Bhutto declared that "peaceful relations with India and Afghanistan will be pursued without prejudice to outstanding disputes."[45] The Kashmir issue is a political gambit which the civilian leaders in Pakistan play according to their advantage. Pakistan's military on the other hand wants to solve the Kashmir issue by destabilizing the region through ISI activities and of late wants to solve the problem by force, as is evident in the Kargil conflict thereby settling all the scores with the Indian military about their previous defeats. To de-stabilize the communal harmony in India, Pakistan based terrorists have spread their operations to other parts of India and are not limited to Kashmir. In accordance with General Kidwai's nuclear strategy of Pakistan regarding nuclear strike for domestic destabilization of Pakistan by India: if India, follows the same strategy, it should have nuked Pakistan long ago for carrying out domestic destabilization in India through its

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[43] BBC News, "Excerpts from Pakistani President Pervez Musharraf's Address to the Nation," http://news.bbc.co.uk/2/hi/not_in_website/syndication/monitoring/media_reports/2011509.stm [Accessed June 12, 2006].

[44] People's Daily, "Kashmir Remains Core Issue Between India, Pakistan: Pakistani PM," http://english.people.com.cn/200403/17/eng20040317_137708.shtml [Accessed July 18, 2006].

[45] Hasan Surror, "Nawaz Sharif Sign, Charter of Democracy," *The Hindu*, May 16, 2006.

terrorist network. The major attacks outside Kashmir during 2001-2006 are placed at Table 2.

Place	Date	Causalities
Indian Parliament, New Delhi	13 Dec 2001	09 killed
American Cultural Center, Kolkata	22 Jan 2002	04 killed and 21 injured
Twin Blasts, Mumbai	25 Aug 2005	46 killed and over 160 injured
Akshardham Temple, Gandhinagar	24 Sep 2002	29 killed and 74 injured
Makeshift Ram temple, Ayodhya	05 Jul 05	1 killed and 3 injured
Jaunpur Train Explosion, Uttar Pradesh	29 Jul 2005	10 killed and 50 injured
Marketplaces, New Delhi	29 Oct 2005	70 killed several injured
Indian Institute of Science, Bangalore	28 Dec 2005	1 killed and 05 injured
Sankat Mochan Temple, Varanasi	07 Mar 2006	100 injured
RSS Headquarters, Nagpur	1 Jun 2006	None
Mumbai Train blasts	11 Jul 2006	190 killed and 625 injured

Table 2. Major Terrorist Attacks in India Outside Kashmir (2002-2006)[46]

Growing terrorist's activities around India from Pakistan based terrorist camps is a big concern for Indian policymakers. The mounting suffering and anguish amongst the Indian people could lead to a possible limited war between Indian and Pakistan. During the 2001-02 military stand-off between India and Pakistan, a limited war was threatened but was never fought. The initial threats from India were complied by Pakistan by banning the terrorist organizations Lashkar-e-Toiba and Jaish-e-Mohammed, and President Pervez Musharraf publicly promised not to allow Pakistani territory to be used as a launching ground for terrorism in Kashmir.[47] Kargil has proved that the stability/instability paradox prevails in South Asia and a limited war can be fought. The chances of a limited war erupting into a nuclear confrontation cannot be ruled out, but

[46] Samrat Sinha, "Major Terrorist attacks in India (2000-2006)," IPCS, http://www.ipcs.org/IPCS-Special-Report-27.pdf [Accessed July 31, 2006].

[47] B. Muralidhar Reddy, "Musharraf bans Lashkar, Jaish; invites Vajpayee for talks," *The Hindu*, January 13, 2002.

Pakistan would have to pay a heavy price if it escalates one against India. As former defense Minister George Fernandes puts it, after an initial Pakistani nuclear strike on India, "we may have lost a part of our population," but after India's retaliatory strike on Pakistan, "Pakistan may have been completely wiped out."[48]

a. Pakistan's Nuclear Arsenal

Pakistan has been trying to acquire nuclear bombs since the 1970s. After the Indo-Pak war in 1965, former Prime Minister of Pakistan Zulfiqar Ali Bhutto asserted in 1965 that "if India builds the bomb, we will eat grass or leaves, even go hungry, but we will get one of our own."[49] But the necessary impetus to the Pakistani nuclear program was given by Bhutto after the defeat in the 1971 war with India. The Pakistani nuclear program has been shrouded by illegal smuggling and through clandestine assistance by other countries. The illegal activities were carried out by the key player in Pakistani's enrichment capability, Dr. Abdul Quadeer Khan. He returned to Pakistan in 1975 with knowledge of gas centrifuge technologies that he acquired at the classified URENCO uranium enrichment plant in the Netherlands and also stole uranium enrichment technologies from Europe.[50] Another factor in the development of nuclear weapons in Pakistan has been the "Chinese connection." China is known to have provided a complete nuclear weapon design to Pakistan along with sufficient weapon-grade uranium for two tests, established a special industrial furnace at the Khushab facility to produce plutonium, transferred enough tritium gas for triggers for ten nuclear weapons, trained Pakistani technicians, and guided Pakistani scientists in propellant and warhead technologies.[51]

The Pakistani's nuclear weapons are primarily based on Highly Enriched Uranium (HEU) although the production of weapon grade plutonium is carried out on a

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[48] Kapur, "India and Pakistan's Unstable Peace," 147.

[49] John F. Burns, "Nuclear Anxiety: The Overview, Pakistan Answering India, Carries Out Nuclear Tests; Clinton's Appeal rejected," *New York Times*, May 29, 1998.

[50] Federation of American Scientists, "Pakistan Nuclear Weapons, A Brief History of Pakistan's Nuclear program," http://fas.org/nuke/guide/pakistan/nuke/index.html [Accessed July 12, 2006].

[51] K. Subrahmanyam, "Gospel According to Lucifer," *The Economic Times*, July 10, 1998.

smaller scale at the Khushab nuclear reactor. The estimates of nuclear arsenal in Pakistan's inventory are mentioned below:

- It is assumed that Pakistan's Kahuta enrichment plant is able to produce between 80-140 Kilograms (Kgs) [median 110 Kgs] of weapon-grade uranium per year. The amount of HEU required for a bomb is believed to range between 12-25 Kgs [median 18 Kgs] depending on weapon design.[52]
- The Khushab nuclear reactor is able to produce 1.7-13 Kgs [median approximately 8 Kgs] weapon grade plutonium per year.[53] It is assumed that 5-7 Kgs [median 6 Kgs] of plutonium is required for one warhead.[54]
- Recent media reports suggest that Pakistan's Khushab nuclear site show what appears to be a partially completed heavy water reactor capable of producing enough plutonium for 40 to 50 nuclear weapons a year, which is a 20 fold increase from Pakistan's current capabilities.[55]

The production capabilities mentioned above are shrouded with uncertainties about the year in which these production levels were achieved. During the HEU moratorium from 1991 to 1998, the Low Enriched Uranium (LEU) produced till 1998 and 1999 were upgraded in the enrichment plants to weapon-grade uranium.[56] The Khushab research reactor that is capable of producing weapon-grade plutonium was made operational in April 1998.[57] The summary of Pakistan's fissile material and nuclear weapons inventories for HEU from 1991 and for weapon-grade plutonium from 1998 considering the estimates mentioned above are listed in Table 3.

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[52] Peter R. Lavoy, "Managing south Asia's Nuclear Rivalry: New Policy Challenges for the United States," *The Nonproliferation Review*, Fall-Winter 2003, 87.

[53] David Albright, "India's and Pakistan's Fissile Material and Nuclear Weapons Inventories, end of 1999," Institute for Science and International security (ISIS), http://www.isis-online.org/publications/southasia/stocks1000.html [Accessed July 23, 2006].

[54] Lavoy, " Managing," 87.

[55] *Washington Post*, "Pakistan Expanding Nuclear Program,", July 24, 2006.

[56] Albright, "India's and Pakistan's Fissile."

[57] Federation of American Scientists, "Pakistan Nuclear Weapons."

	Fissile Material			Nuclear Weapons		
	Low	Medium	High	Low	Medium	High
Uranium	1200	1650	2100	48	92	175
Plutonium	13.6	64	104	2	11	21
Total				50	103	196

Table 3. Pakistan's Fissile Material and Nuclear Weapons (2006)

b. Pakistan's Nuclear Delivery Systems

Pakistan's nuclear delivery platforms are based on land-based ballistic missiles and bombers. The estimates and capabilities of Pakistan's nuclear delivery platforms are shown in Table 4.

Type	Number	Year Deployed	Estimate Range (Km)	Payload	Source
Land-based missiles					
Haft 1	18	1983	80	500	Indigenous
Haft 2 (Abdali)	1	?	180	500	Indigenous/China
Haft 3 (Ghaznavi)	?	1995	290	?	Indigenous/China
Haft 4 (Shaheen1)	20	?	600	1000	Indigenous/China
Haft 5 (Ghauri)	5-10	1998	1500	700	Indigenous/DPRK
Haft 6 (Shaheen 2)	?	?	2000-2500	1000-2500	Indigenous/China
M-11	40		300		China
Nuclear capable aircraft					
F- 16 A/B	32	1983	925	4500	United States
Mirage 5 PA	50	?	1300	?	France

Table 4. Pakistan's Nuclear Delivery Platforms[58]

C. EXISTING NUCLEAR COMMAND AND CONTROL STRUCTURE IN INDIA

1. National Command Authority

The information available on the National Command Authority (NCA) is as follows,[59] and is depicted in the Figure 2:

[58] Lavoy, "Managing," 89, and CDI, "Nuclear Weapons Database: Pakistani Nuclear Delivery Systems," http://www.cdi.org/issues/nukef&f/database/panukes.html [Accessed August 15, 2006].

- NCA is a two-layered body comprising of Political Council chaired by Prime Minister and Executive Council chaired by National Security Advisor. The Prime Minister of India is the sole body to authorize the use of nuclear weapons**.**
- The Executive Council provides inputs for decision-making by the Nuclear Command Authority and executes the directives given to it by the Political Council**.**
- The Political Council comprises members of the Cabinet Committee on Security (CCS) and the National Security Advisor (NSA). The Executive Council includes the Chairman Chiefs of Staff Committee (COSC), the three Service chiefs, heads of intelligence agencies, and the scientific organizations engaged in the nuclear program.
- A tri-service command called the Strategic Forces Command (SFC) was created in January 2003 and the official press release on January 4, 2003 described the role of SFC as to manage and administer all strategic Forces.
- In the event that the Political Council orders a nuclear retaliatory strike, the Prime Minister can be expected to directly contact the SFC and not work through the agency of the Executive Council, which is depicted by the heavy bold arrow in Figure 2.

[59] Gaurav Rajen, "Nuclear Confidence-Building Measures in South Asia: Managing Nuclear Operations and Avoiding Inadvertent Nuclear War," Cooperative Monitoring Center, http://www.cmc.sandia.gov/links/cmc-papers/CBMs-southasia.pdf [Accessed March 23, 2006].

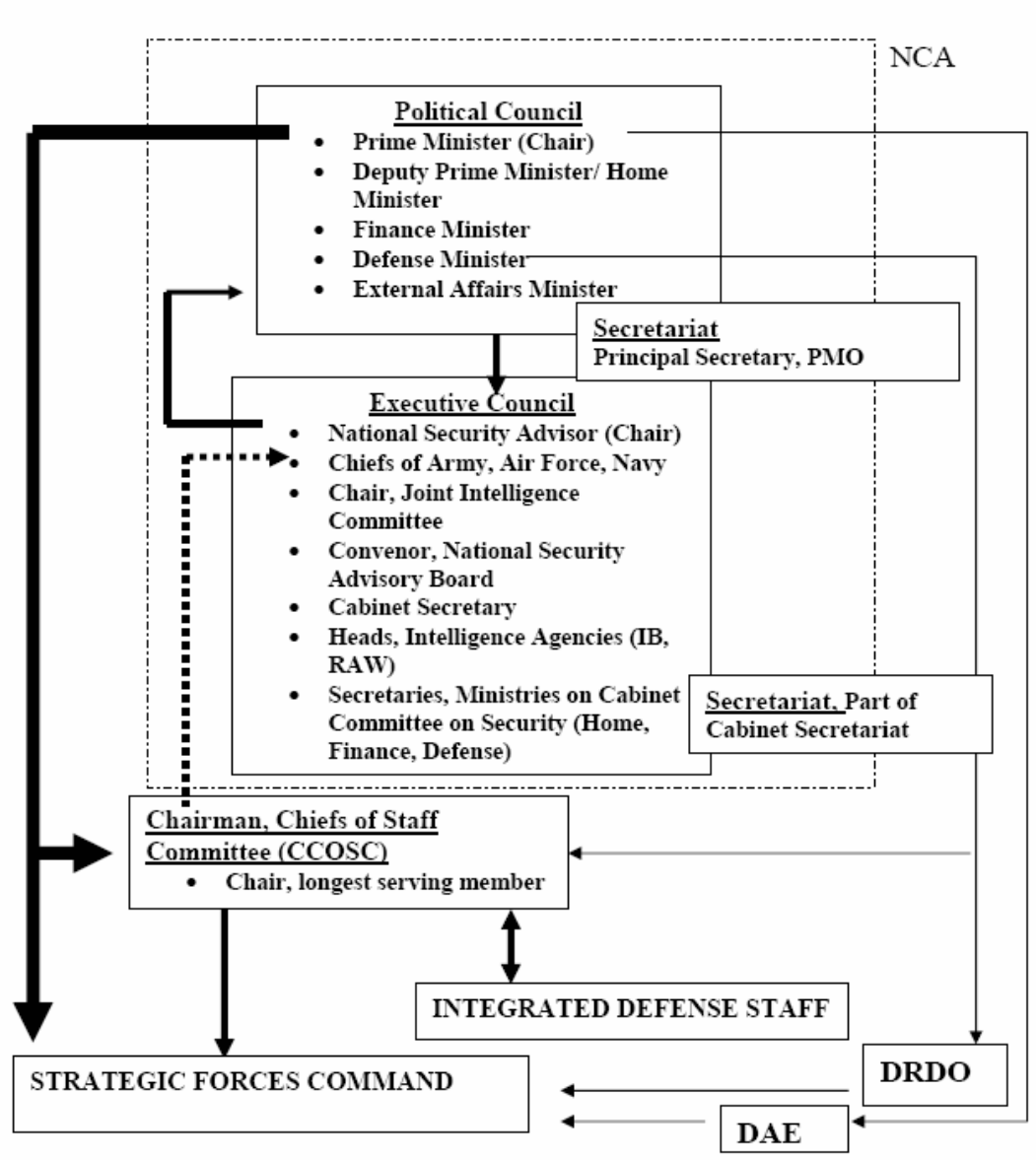

Figure 2. A Schematic Description of the Indian National Command Authority [60]

2. Command and Custody

The command and control of Indian nuclear operations, which are based on No-First-Use, can be divided into four operational tasks[61] of command of the force, custody, integration, and delivery. It is opined that the Indian nuclear force is maintained in the

[60] Rajen, "Nuclear Confidence-Building."

[61] Ashley J. Tellis, *India's Emerging Nuclear posture: Between Recessed Deterrent and Ready Arsenal* (Santa Monica: RAND, 2001), 443.

form of separated components with the responsibilities for the command, custody, integration and use of the weapons distributed amongst the civilians and military as shown in Figure 3. The command and control structure of nuclear weapons in India is highly assertive with strict civilian control. The NFU policy of India places its nuclear weapons in a "de-mated" posture in peacetime which implies that the warheads are separated from the delivery vehicles, with scientists controlling the warheads and the armed forces manning the delivery vehicles. A nuclear warhead comprises the nuclear core and the trigger assembly and these two major parts are stored separately by the Department of Atomic Energy (DAE) and the Defense Research and Developmental Organization (DRDO) scientists respectively.[62] The DAE has always been under the Prime Minister's personal charge and the DRDO is under the Defense Minister.

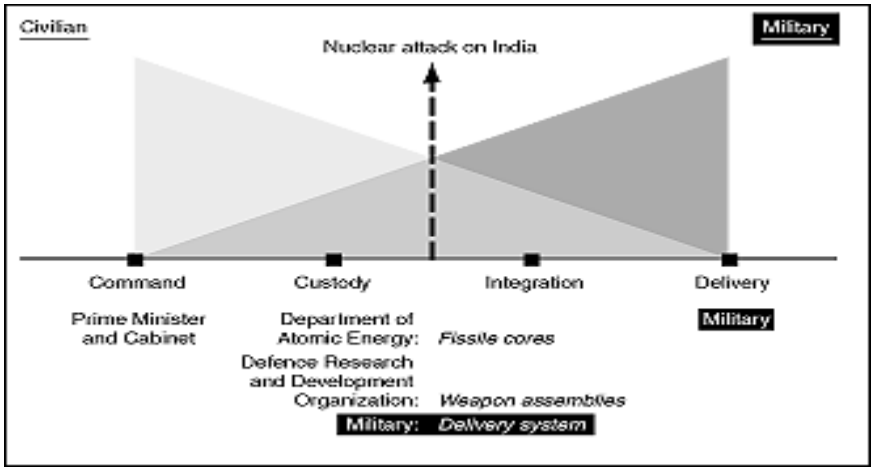

Figure 3. India's Assertive Command System-The "Baseline" Model [63]

3. Command and Control

The military aspect of the command and control cycle of the nuclear weapons actually commence after the nuclear attack on India has taken place, and before that it can be assumed that only command and custody is in force. After the decision to retaliate has been determined with the inputs from NCA (see Figure 2) the Prime Minister of India will initiate the process of integration (see Figure 3) of the nuclear weapons. The process

[62] Gurmeet Kanwal, "Safety and Security of India's Nuclear Weapons," *Strategic Analysis*, vol 25 (April 2001), http://www.ciaonet.org/olj/sa/sa_apr01kag01.html [Accessed May 27, 2006]

[63] Tellis, *India's Emerging*, 442.

of integration requires a high level of coordination amongst the DAE, DRDO and the military. Within the military the coordination is going to be amongst the Chairman Chief of Staff Committee (COSC), Chief of Integrated Defense Staff (CIDS) and the Commander-in Chief Strategic Force Command (C-in-C SFC). The COSC normally reports to the Defense Minister, but will report on nuclear matters to the NCA[64] as depicted by the two sided arrows in Figure 4. It can be presumed that as a crisis escalates, under the authorization of the Political Council and with the involvement of the DRDO and DAE, the SFC will receive the fissile cores well before any final authorization for use by the Indian Prime Minister.[65]

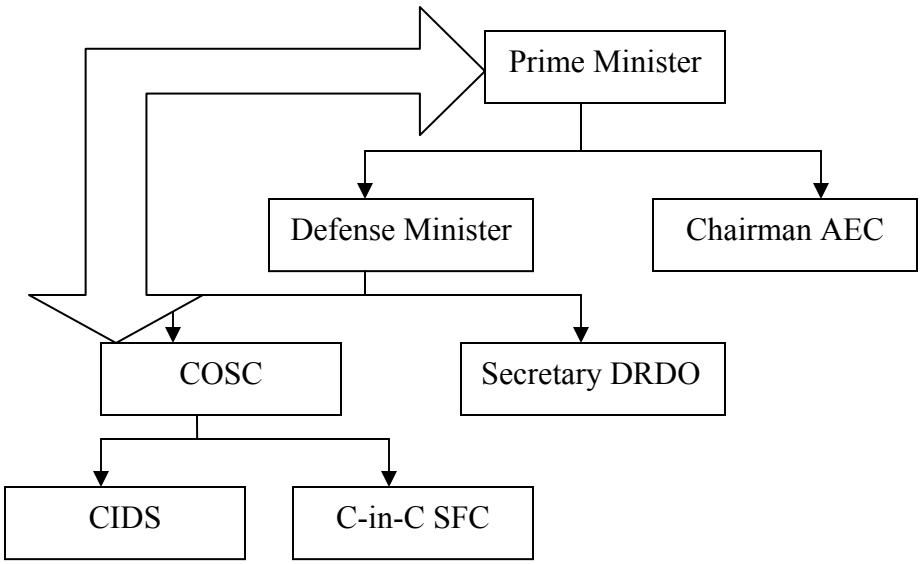

Figure 4. Indian Nuclear Command and Control

D. INDIAN NUCLEAR FORCE POSTURE

The force posture and organization maintained by India in order to mitigate the threat perceived from China and Pakistan would be covered by looking at the Indian nuclear arsenal and delivery platforms.

64 Rajen, "Nuclear Confidence-Building."

65 Ibid.

1. India's Nuclear Arsenal

India relies on plutonium for its weapons and 25-40 Kgs worth of bomb-grade plutonium is separated by Indian scientists every year.[66] The nuclear fissile material stockpiles and weapon capabilities of India are shown in Table 5.

	Fissile Material			Nuclear Weapons		
	Low	Medium	High	Low	Medium	High
Uranium	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Plutonium	300	430	640	40	80	130
Total				40	80	130

Table 5. Indian Nuclear Arsenal[66]

2. India's Nuclear Delivery Platforms

The nuclear forces of India, as outlined in the DND, will be based on a triad of aircraft, mobile land-based missiles and sea based assets. The present nuclear delivery platforms in Indian inventory are depicted in Table 6.

Type	**Number**	**Estimate Range (Km)**	**Source**
Land-based missiles			
Prithvi 1	?	150	Indigenous
Prithvi 2	?	250	Indigenous
Prithvi 3	?	350	Indigenous
Agni1	?	700-900	Indigenous
Agni2	?	2000-3000	Indigenous
Agni3	?	3500-4000	Indigenous
Nuclear capable aircraft			
Mirage-2000H	35	1205	France
Su-30 MKI	18	3000	Russia
Jaguar S(I)	88	850	UK/France
Mig-27 ML	214	500	Russia

Table 6. India's Nuclear Delivery Systems[67]

[66] Lavoy, "Managing," 88.

[67] Ibid.

E. LIMITATIONS OF EXISTING COMMAND AND CONTROL SYSTEM

India has structured its nuclear command and control system in a unique way which is quite different from the ones existing in other nuclear states. There is no model available for India on which it can base its nuclear command and control system. The Indian nuclear command and control system is in its emerging state, and therefore some limitations are bound to exist in the system. The Cold War has demonstrated that a nuclear command and control system takes decades to mature into a stable system.

1. Ambiguities in Minimum Credible Deterrence

India's nuclear policy is based on two important pillars of NFU and minimum credible deterrence. The NFU is a well thought out policy to balance two simultaneous threats in which one adversary has a superior nuclear force while the other has an inferior one. But the dimension of minimum credible deterrence can not be applied to both of them simultaneously. Rajesh M. Basrur, a noted strategist, asserts that the concept of minimum credible deterrence is not entirely clear. He writes,

> In essence, the Indian conception of minimum credible deterrence encompasses the understanding that it is not necessary to have large numbers of sophisticated weapons to deter nuclear adversaries; that nuclear "balances" are not meaningful; and that weapons need not be deployed and kept in a high state of readiness in order that deterrence be effective. Beyond this, important questions remain. While the development of capabilities in technology and organization proceeds apace, nobody is quite clear about what minimum deterrence means. How many weapons are adequate, and of what kind? Might deployment become necessary at some point of time, and if so, under what circumstances? Is war still possible, if so, how?[68]

The NFU and the de-mated posture together do not demonstrate a minimum credible deterrence. India needs to clearly define the minimum credible deterrence so that appropriate nuclear posture can be evolved from it in order to deter India's adversaries.

2. Limited Role of Indian Armed Forces

General Ved Prakash Malik, former Chief of the Army Staff, points out that the armed forces of India are kept out of the national security loop and were not adequately

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[68] Rajesh M. Basrur, *Minimum Deterrence and India's Nuclear Security* (Stanford: Stanford University Press, 2006), 1.

consulted by the government on operational and strategic matters, and this can result in large communication gaps between what is politically desirable and what is being planned by the military.[69] Figure 3 illustrates that the military's involvement starts after the nuclear attack on India and terminates at the successful delivery of the nuclear weapons. It would be customary for the government of India to consult the C-in-C SFC or COSC for nuclear targeting and one of the primary inputs for targeting will be the number of nuclear warheads available. The military is not involved in the decision making process regarding the quantity of nuclear weapons required by the government of India in accomplishing its nuclear strategic policies. The decision regarding the number of nuclear warheads is exceptionally political and so it is believed that the military will be unaware of the number of nuclear warheads which India possess until the beginning of the mating of the nuclear weapons. The formulation of the targeting matrix at such a late stage after a nuclear attack on India could lead to the problems of "what is politically desirable and what is being planned by the military" as purported by General Malik.

3. Absence of Successor

Clause 5.1 of the draft nuclear doctrine states that the authority to release nuclear weapons for use resides in the person of the Prime Minister of India or the designated successor(s). No official list has been promulgated so far and if transparency is shown by promulgating the list of successor(s) as is done in the case of the United States, then it will streamline the nuclear chain of command.

4. Absence of Common Communication Backbone

Communications are going to be the crux of the command and control system and a lot is dependent on them especially after absorbing a first strike. The NFU policy will ensure that nuclear weapons are widely dispersed and essentially mobile and they will be moving around at frequent intervals in order to evade the first strike by nuclear or conventional attack. The dispersion of the nuclear weapons therefore makes the requirement of reliable communications amongst these storage locations with the command authority a basic necessity. Since a war in general and a nuclear strike in particular is going to be a coordinated effort, communication among each component of

[69] Rahul Bedi, "A Credible Nuclear Deterrent," Frontline, www.hinduonnet.com/fline/fl2007/stories/20030411003009700.htm [Accessed May 12, 2006].

the Armed Forces along with Command Center needs no emphasis. The command, control and communication systems in the three services of our defense forces have developed independently without any meaningful efforts towards evolving a joint architecture for such systems, and there are no dedicated defense satellite systems.[70]

5. Limitations of C-in-C SFC as an Operational Commander

The C-in-C SFC is responsible for the administration of all the nuclear forces of India. The open source literature reveals that C-in-C SFC does not hold any nuclear delivery systems. How and when he will have the custody of all the nuclear delivery platforms or will these be seconded to him during the crisis[71] are some on the unanswered questions about the operational functioning of C-in-C SFC which needs to be clarified.

F. CONCLUSION

The credibility of nuclear deterrence by a deterrer is always a big question mark as it is impossible to gauge the psychological effect of it on the deterree under all circumstances. The nuclear policy, posture, and the effectiveness of the command and control of the nuclear weapons are the two main inputs for a credible deterrence. The two adversaries with differing nuclear postures and nuclear capabilities can not be scaled simultaneously under the "minimum credible deterrence" in conjunction with de-mated weapons. The overt demonstration of nuclear capabilities by India in May 1998 has demanded a requirement of a robust command and control system. The command and control of nuclear weapons during the de-mated state is relatively easy, but it will be difficult to manage during the fog of war. The C-in-C SFC should have a certain number of nuclear assets deployed under his operational command such that they can be used effectively in a retaliatory strike. A healthy civil-military relation on such an important issue as nuclear command and control is indisputable, and the integration of the military

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[70] Vinod Anand, "Joint Development of Inter-Services Network and C4I2 Systems," *Strategic Analysis*, October 2000.

[71] John Cherian, "The Nuclear Button," Frontline, http://www.frontlineonnet.com/fl2002/stories/20030131007103200.htm [Accessed May 31, 2006], and R. Prasannan, "Not Trigger-Happy," The Week, http://www.the-week.com/23jan19/events5.htm [Accessed May 31, 2006].

into all decision-making processes relating to nuclear issues will only support the political leaders in accomplishing the strategic objective of the country.

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III. NUCLEAR COMMAND AND CONTROL ORGANIZATION OF THE UNITED STATES

> Communications are the nervous system of the entire SAC organization, and their protection is therefore, of the greatest importance. I like to say that without communications, all I control is my desk, and that is not a very lethal weapon.[72]
>
> General T. S. Power, CINCSAC, May 1959

A. INTRODUCTION

The United States was the first and only country to use nuclear weapons. Nuclear weapons were first invented by the United States, and the world discovered their destructive power when they were used on Hiroshima and Nagasaki. With such enormous destructive potential, nuclear weapons remained a prized possession of the United States only for a few years as other states accelerated their nuclear programs. The Soviets were the first to break the monopoly of the United States and produced nuclear weapons in August 1949. Since then, there was a race between the United States and Soviets (presently Russia who is the inheritor of the Soviet's entire nuclear arsenal) to outpace the other in the nuclear game. During the Cold War both the superpowers amassed a substantial number of nuclear weapons based on their policies of Mutually Assured Destruction (MAD). Both countries established elaborate command and control infrastructure based on their Launch on Warning (LOW) posture. The command and control system established by the United States has evolved considerably over the last six decades to incorporate extensive positive control over the nuclear arsenal and at the same time strengthening the negative control by minimizing the risks of inadvertent, accidental or unauthorized firing. The efficient management of nuclear forces during peacetime has been mastered by the United States and adequate measures have been implemented in their command and control system for survivability in order to pose a credible deterrent against the aggressor.

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[72] Federation of American Scientists, "Communications, Command, Control and Intelligence, United States Nuclear forces," http://www.fas.org/nuke/guide/usa/c3i/index.html [Accessed July 12, 2006].

In order to establish a credible deterrence, not only the destructive power of the nuclear weapons is taken into account but also the complex organization looking after their command and control. The establishment of a robust nuclear command and control system by the United States established a stronger strategic stability with the Soviet Union and was one of the most influential moves towards avoiding a nuclear war. It is worthwhile to study the command and control of the United States in order to determine the essential requisites regarding procedures, components and the interaction involved at various political and military levels for their nuclear operations. This comparative study later assists in formulating a tailor-made command and control system for Indian nuclear forces.

The study of the U.S. command and control system includes: the evolution of their doctrine, the key players in decision-making, command centers including alternate arrangements for controlling nuclear operations, nuclear command and control cycle, the infrastructure and role of early warning systems, communications network, the technical and organizational procedures involved for establishment of efficient civilian control and measures taken to overcome command and control system vulnerabilities. In the Indian context, such an elaborate system may not be required, but certainly all these aspects mentioned above need to be studied as they might be useful when assimilating the whole Indian nuclear command and control system.

B. U.S. NUCLEAR DOCTRINE

The nuclear doctrine of a state provides the necessary input for establishing the building blocks of a nuclear command and control system. Nuclear doctrine is the single most important criteria on which the development, deployment, and employment of nuclear forces is based upon. The U.S. nuclear doctrine can be divided into two phases: one during the Cold War and the other after the 2001 Nuclear Posture Review (NPR).

1. Nuclear Doctrine During the Cold War

Deterrence has remained the cornerstone element of the U.S. nuclear doctrine ever since the beginning of the Cold War. Deterrence refers to a policy of preventing or

discouraging an action by confronting an opponent with risks he is willing to run.[73] The concept of deterrence took a major turn after the introduction of nuclear weapons. Subsequently, a number of U.S. deterrent strategies have evolved over the years such as City Bursting, Massive retaliation, Mutual Assured Destruction (MAD), Flexible response and others. For nuclear deterrence to work it is necessary that the opponent is convinced that one has sufficient weapons to retaliate, even after a first strike. Deterrence strategies can be divided into three broad categories: deterrence by denial, deterrence by punishment, and deterrence by defeat. The U.S. position was deterrence by punishment, which means that the side that might start a war would not do so because it would believe that the U.S. could inflict "unacceptable damage" (i.e., punishment) on the attacking side.[74] Deterrence by punishment remained the main theme of the U.S. strategic doctrine during the Cold War, and this was demonstrated through different deterrence postures attained by the successive U.S. governments.

The No-First-Use concept, which was suggested many times by the Soviets, was always rejected by the United States. Secretary of State Alexander M. Haig, on April 6, 1982, summed up the reason for the rejection as "a pledge of No-First-Use effectively leaves the West nothing with which to counterbalance the Soviet conventional advantages and geopolitical position in Europe."[75] The option of First-Use posture was maintained by the United States throughout the Cold War. Another nuclear posture which the U.S. maintained during the Cold War was Launch on Warning (LOW). The U.S. strategic posture gravitated to this option between the late 1960s and early 1970s, and it became entrenched after the U.S. deployed a constellation of early warning satellites in the early 1970s.[76]

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[73] Honore M. Catudal, *Nuclear Deterrence-Does it Deter?* (Humanities Press, 1986), 37.

[74] Catudal, *Nuclear Deterrence*, 50.

[75] Laszlo Borhi, "The United States and East Central Europe, 1945-1990," http://www.coldwar.hu/html/en/chronologies/borhi3.html [Accessed May 13, 2006]

[76] Bruce G. Blair, *The Logic of Accidental War*, (Washington D.C.: The Brookings Institution, 1993), 173.

2. Nuclear Posture Review (2001)

The Nuclear Posture Review (NPR) 2001 takes into account the existing security situation which the U.S. faced after the Cold War. It is opined that Russia is no longer an enemy, and there is a need to transform the nuclear posture to align with the ongoing transformation of the U.S. conventional forces. The salient points of NPR 2001 are mentioned below:

- It is a blueprint for transformation of strategic forces. For the existing security situation a mix of capabilities, offensive and defensive, nuclear and conventional is required.
- Replace the strategic Cold War Triad with a New Triad that integrates conventional and nuclear offensive strike capabilities, active and passive defenses, and a responsive infrastructure to provide a more diverse portfolio and capabilities against immediate, potential and unforeseen contingencies. The new strategic Triad is depicted in Figure 5.
- The nuclear Triad will include about one-third of operationally deployed warheads of the current strategic nuclear force. Nuclear-armed sea-launched cruise missiles, removed from ships and submarines under the 1991 Presidential Nuclear Initiative, are maintained in a reserve status. [77]

[77] U.S. Department of Defense, "Nuclear Posture Review (NPR 2001)," http://www.defenselink.mil/execsec/adr2002/toc2002.htm [Accessed May 14, 2006].

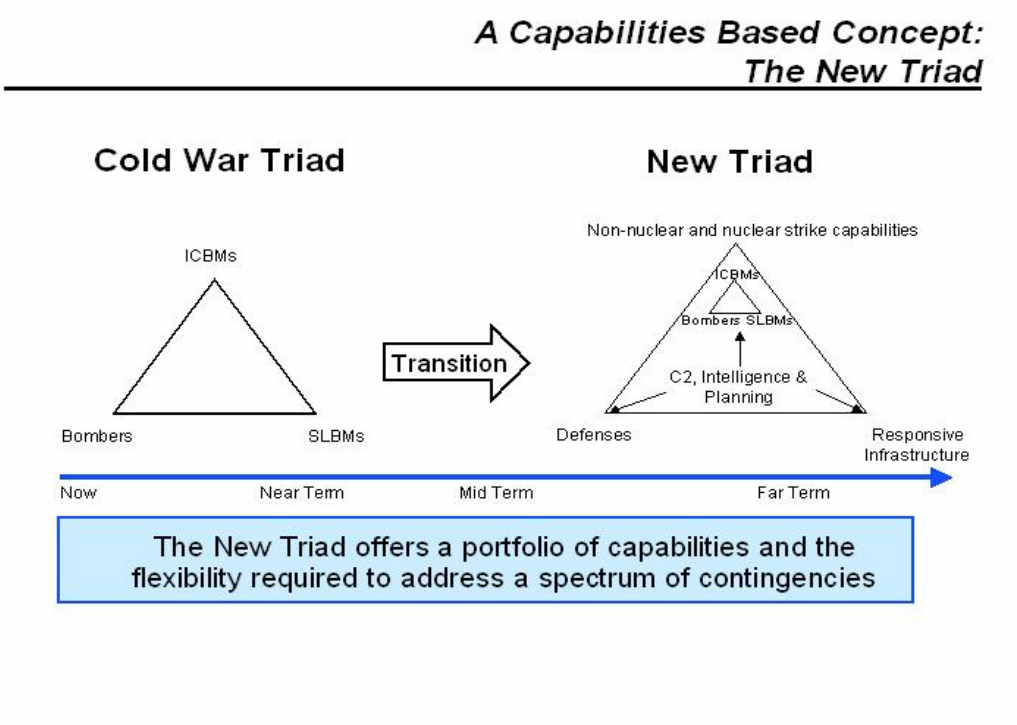

Figure 5. The New Triad[78]

The nuclear doctrine of a country is a by-product of its national strategic posture. It is important that the nuclear doctrine be commensurate with the strategic goals of a country. A review of the nuclear doctrine at regular intervals is essential so as to align itself with the changes in external threats. A nuclear doctrine provides the key guidelines for the infrastructure, procedures and technical aids required for raising a new nuclear command and control system.

C. U.S. NUCLEAR COMMAND AND CONTROL SYSTEM

The U.S. Department of Defense (DoD) defines a command and control system as "the facilities, equipment, communications, procedures, and personnel essential to a commander for planning, directing, and controlling operations of assigned forces pursuant to the mission assigned."[79] The Nuclear Command and Control System (NCCS) provides the necessary support to the President, Secretary of Defense, Joint Chiefs of

[78] U.S. Department of Defense, "The New Triad," http://www.defenselink.mil/news/Jan2002/020109-D-6570C-010.jpg [Accessed May 14, 2006].

[79] U.S. Department of Defense, "Dictionary of Military and Associated Terms," *Joint Publication* (JC)-102, https://134.11.61.26/ArchivePub/Publications/Joint/JP/JP%201-02%2020010412.pdf [Accessed May 15, 2006].

Staff and combatant commanders of Unified Commands in carrying out the U.S. nuclear operations. The NCCS must support situation monitoring, tactical warning, and attack assessment of missile launches, senior leader decision making, dissemination of Presidential force-direction orders, and management of geographically dispersed forces.[80] The most salient features of the U.S. nuclear command and control system that can be taken into account for incorporation into an Indian system are supreme command, command centers, and the command and control cycle.

1. Supreme Command

The releasing authority for nuclear weapons is the President of the United States, who is the Commander-in-Chief of the Armed Forces of the United States. The U.S. government has promulgated a line of succession to the presidency in case of the death of the President during a national emergency, such as a nuclear war. The line extends from the Vice President to the speaker of the House of Representatives, to the President pro tem of the Senate, and thence through nine members of the cabinet, thus providing twelve successors to the President.[81]

2. Command Centers

The main component of the NCCS is the National Military Command System (NMCS). The NMCS includes the National Military Command Center (NMCC), the Alternate National Military Command Center and the National Airborne Operations Center (NAOC). The command nodes and supporting elements of NMCS are depicted in Figure 6. The military command centers which are involved in the NMCS and various other organizations and command centers associated with U.S. nuclear command and control are described in the following paragraphs

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[80] Robert D. Critchlow, "Nuclear Command and Control: Current Programs and Issues," *Congressional Research Service Report for Congress* (CRS Order Code RL33408), http://www.fas.org/sgp/crs/nuke/RL33408.pdf [Accessed May 3, 2006].

[81] John Pike, "Continuity of Government," http://fas.org/nuke/guide/usa/c3i/cog.htm [Accessed May 30, 2006]

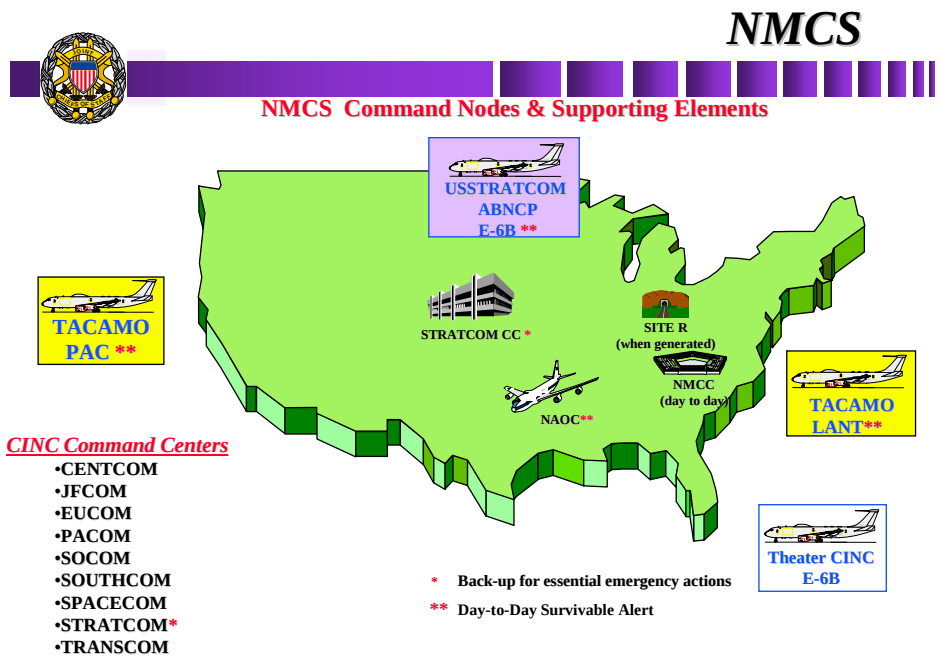

Figure 6. National Military Command System Nodes[82]

a. President's Emergency Operations Center (PEOC)

Below the East Wing of the White House lies the President's Emergency Operations Center (PEOC), which exists to handle nuclear contingencies.[83] The President of the United States authorizes and initiates a nuclear weapons strike using a nuclear briefcase nicknamed the "Football". The main contents of the Football are the "Black Book" of nuclear weapons launch options as formulated in the Single Integrated Operational Plan (SIOP) and the Emergency Action Messages (EAMs) or "go codes" needed to authorize the use of nuclear weapons.[84] The Football is carried by a military officer and follows the President wherever he goes.

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[82] The Armed Forces Communications and Electronics Network, "National Command and Control: That National Miliatry Command System (NMCS)," http://www.afcea.org/education/briefs/LublinUnclass.ppt [Accessed June 12, 2006].

[83] Federation of American Scientists, "President's Emergency Operations Center," http://fas.org/nuke/guide/usa/c3i/peoc.htm [Accessed June 13, 2006].

[84] Steven Aftergood, "The Football," http://fas.org/nuke/guide/usa/c3i/nuclear-football.htm [Accessed June 24, 2006].

b. National Military Command Center (NMCC)

The NMCC is the primary military command center of the United States. The NMCC is located in the Joint Staff area of the Pentagon and is responsible for generating Emergency Action Messages (EAMs) to Launch Control Centers (LCC), nuclear submarines, reconnaissance aircraft, and the battlefield commanders worldwide.[85] The NMCC primarily serves the Secretary of Defense and Joint Chiefs of Staff.

c. Site R

The Site R (R for Raven Rock) at Fort Ritchie, Maryland has been designated as Alternate Joint Communication Center (AJCC).[86]

d. National Airborne Operations Center (NAOC)

The E-4B serves as the National Airborne Operations Center (NAOC) for the President during a nuclear crisis and augments the NMCC in the Pentagon and Alternate National Military Command Center (ANMCC) at Site R.[87] The communication includes both the Extremely High Frequency (EHF) and Very Low Frequency/High Frequency (VLF/HF) links and the E-4B is hardened against Electromagnetic Pulse (EMP).

e. U.S. Strategic Command (USSTRATCOM)

The U.S. Strategic Command (USSTRATCOM) is a joint combatant command based at Offutt AFB in Omaha, Nebraska. Under the Unified Command Plan-02 (UCP-02), USSTRATCOM has four primary responsibilities: global missile defense; global strike; DoD information operations; and global command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR).[88]

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[85] Federation of American Scientists, "National Military Command Center," http://fas.org/nuke/guide/usa/c3i/nmcc.htm [Accessed July 12, 2006].

[86] Tim Brown, "Site-R Raven Rock Alternate Joint Communication Center (AJCC)," http://fas.org/nuke/guide/usa/c3i/raven_rock.htm [Accessed July 12, 2006].

[87] Giles Ebbutt, ed., *Jane's C4I Systems 2005-2006*, (Surrey, UK: Jane's Information Group, 2005), 141.

[88] General Richard B. Myers, (Posture statement before the 108th Congress, House Armed Services Committee, February 5, 2003), http://armedservices.house.gov/openingstatementsandpressreleases/108thcongress/03-02-05myers.html [Accessed May 31, 2006].

USSTRATCOM provides command and control support to all the unified commands of the United States. The command and control support is administered through the following centers.

- USSTRATCOM Global Operations Center (GOC) is the nerve center of USSTRATCOM and updates the commander USSTRATCOM on global situations. The commander USSTRATCOM exercises operational command and control of the U.S. global strategic forces and, based on the Presidential orders, the GOC will execute a global strike mission or send EAMs to the strategic nuclear forces.[89]
- USSTRATCOM Airborne Command Post (ABNCP) is the alternate command post for the commander USSTRATCOM. The role of ABNCP is performed by the E-6B aircraft; it carries Airborne Launch Control System (ALCS) and also serves as the Take Charge and Move Out (TACAMO) relay for U.S. ballistic missile submarines.[90]
- USSTRATCOM Mobile Consolidated Command Center (MCCC), mobile survivable back-up Command, Control, and Communications centers for fixed primary facilities of USSTRATCOM and MCCC's mission is to provide an enduring mobile command center from which to operate during the trans- and post-attack phases of a nuclear attack.[91]

f. Cheyenne Mountain Complex (CMC)

The Cheyenne Mountain Complex (CMC) outside Colorado Springs, Colorado is the main correlation center of the Integrated Tactical Warning and Attack Assessment (ITW/AA) system and conducts missile, atmospheric and space warning activities for North American Aerospace Defense Command (NORAD) and U.S. Space Command (USSPACECOM).[92] The ITW/AA system uses the inputs from U.S. early warning satellite systems and the early warning radar systems.

The command centers, including alternate and mobile centers, provide the necessary command and control link for the political and military leadership with the

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[89] United States Strategic Command, "USSTRATCOM Global Operations Center," http://www.stratcom.mil/fact_sheets/fact_goc.html [Accessed June 12, 2006].

[90] Ebbutt, *Jane's C4I Systems*, 139-140. The airplane can deploy a two and half mile long trailing wire antenna and communicate directives to the submarines over its VLF/LF system.

[91] Federation of American Scientists, "Mobile Consolidated Command Center," http://fas.org/nuke/guide/usa/c3i/cmah.htm [Accessed June 12, 2006].

[92] Federation of American Scientists, "Cheyenne Mountain Complex," http://fas.org/nuke/guide/usa/c3i/cmc.htm [Accessed June 12, 2006].

warfighting forces. The U.S. system is based on a dispersed model so as to absorb a massive decapitative strike without ceding a complete annihilation of the command centers. The need for the command centers cannot be ruled out as they are the nodes for the umbilical link for disseminating orders and receiving feedback such as situational reports. For India, the command centers on such a large scale are presently not required, but at least one national command center and one military command center (the same as the command center of USSTRATCOM) is absolutely essential.

3. Command and Control Cycle

The command and control cycle for nuclear operations starts with its peacetime operations which might transcend into a crisis, and which if not handled properly, could lead to a nuclear war. The command and control of nuclear weapons can usefully be divided into seven stages: target planning, strategic warning, tactical warning, attack assessment, decision, and orders to the field and post attack assessment.[93] Valery E. Yarynich has concisely described the U.S. command and control cycle starting from the pick-up of a missile attack by the early warning system of the United States:

> A signal from the Cheyenne Mountain Complex is sent to the U.S. president, the secretary of defense, the STRATCOM command centers, and other joint command centers. After a short teleconference, if a decision to retaliate is made, the NCA [president] uses the 'Football" to give a battle action order to the nuclear missile forces (an EAM signal with launch codes). At the same time, the U.S. population is informed through the EAS system. Reserve command posts, including airborne command posts of the NCA (E-4B NAOC) and STRATCOM (E-6B) and mobile consolidated command centers of STRATCOM and SPACECOM (MCCCs) are activated. The reserve command centers are authorized to act if the primary command centers are disabled. The TACAMO E-6A aircraft system is activated and deployed. The crews of submarines are informed through this system and other long wave (ELF and VLF) radio communication systems. Commands from the NCA and STRATCOM, including missile launch commands, are transmitted to the ICBM Launch Control Centers (LCCs), strategic fighter planes, shore and air transmission stations simultaneously through all available communication systems (GCCS, SACCS, SLFCS and others) using cable (TCS), short wave (HF, UHF), long wave (VLF) and satellite (MILSTAR, AFSATCOM, and other) channels. The end-to-end message delivery time

[93] Walter Slocombe, "Preplanned Operations," in *Managing Nuclear Operations*, ed. Ashton B. Carter, John D. Steinbruner and Charles A. Zraket, (The Brookings Institution, 1987), 126-140.

to missile launch does not exceed one minute. Minutemen-M and M-X missiles are launched by LCCs; however, if the LCCs are disabled, remaining missiles can be launched by E-6B aircraft through the ALCC terminal.[94]

The command and control cycle with its connectivity to various nodes is depicted in Figure 7.

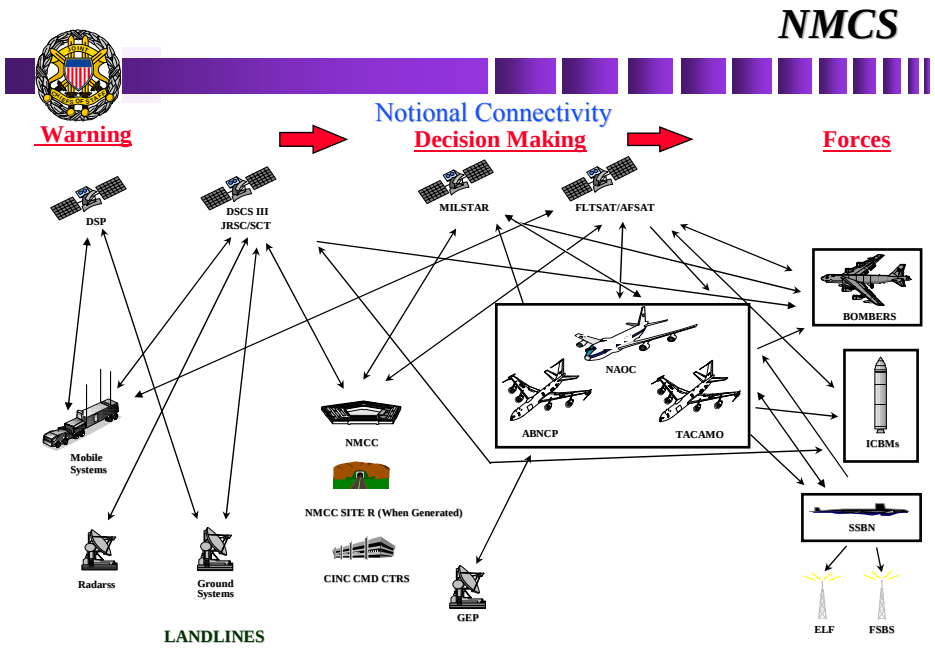

Figure 7. National Military Command System Connectivity to the Forces[95]

During peacetime and crisis, the alert posture of U.S. nuclear forces is declared through Defense Conditions (DEFCON). The descriptions of five DEFCON[96] are mentioned below:

- DEFCON 5 Normal peacetime readiness.

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[94] Valery E. Yarynich, *Nuclear Command, Control, Cooperation* (Center for Defense Information, 2003), 193-195.

[95] The Armed Forces Communications and Electronics Network, "National Command and Control: That National Miliatry Command System (NMCS)," http://www.afcea.org/education/briefs/LublinUnclass.ppt [Accessed June 14, 2006].

[96] Federation of American Scientists, "Defense Condition (DEFCON)," http://fas.org/nuke/guide/usa/c3i/defcon.htm [Accessed June 4, 2006].

- DEFCON 4 Normal, increased intelligence and strengthened security measures.
- DEFCON 3 Increase in force readiness above normal readiness.
- DEFCON 2 Further increase in force readiness, but less than maximum readiness.
- DEFCON 1 Maximum force readiness.

The normal alert status of SAC (predecessor of USSTRATCOM) was a notch higher than the rest of the American forces at DEFCON 4, and during the Cuban crisis the SAC forces were moved to DEFCON 2.[97]

The command and control cycle of the United States is based on LOW to cater for a surprise attack; in other conditions the posture will escalate progressively. It is unlikely that India would embrace a "hair-trigger" posture of the Cold War. However, the communications will play an important role in the command and control of the de-mated nuclear arsenal and therefore alternate communications links are absolutely essential. Also, the promulgation of defense conditions by the Indian government will not only put the nuclear forces on the required alert, but also project the intent of the government.

D. U.S. EARLY WARNING SYSTEMS

The Early Warning System (EWS) deployed by the United States for providing information regarding an approaching missile against the United States can be broadly divided into satellite and radar systems. The satellite system provides information on missiles shortly after their launch, whereas the radar system is used to detect missiles as they approach their targets.

1. U.S. Early Warning Satellites

The mainstay of the U.S. early warning satellite system is the constellation of geosynchronous satellites belonging to the Defense Support Program (DSP). The first DSP satellite was launched in 1970 and since then a number of them have been launched with five major upgrades, including capabilities of missile warning missions in mid-wave infrared using Mercury Cadmium Telluride (HgCdTe) infrared sensors.[98] The DSP

[97] Bruce G Blair, "Alerting in Crisis and Conventional War," in *Managing Nuclear Operations*, ed. Ashton B. Carter, John D. Steinbruner and Charles A. Zraket, (The Brookings Institution, 1987), 78.

[98] U.S. Air Force, "Defense Support Program (DSP)," http://www.losangeles.af.mil/SMC/PA/Fact_Sheets/dsp%20fact%20sheet.pdf [Accessed June 12, 2006].

satellites provide early warning for ICBMs and the area of coverage of the U.S. early warning satellites along with their geosynchronous positions are depicted in Figure 8.

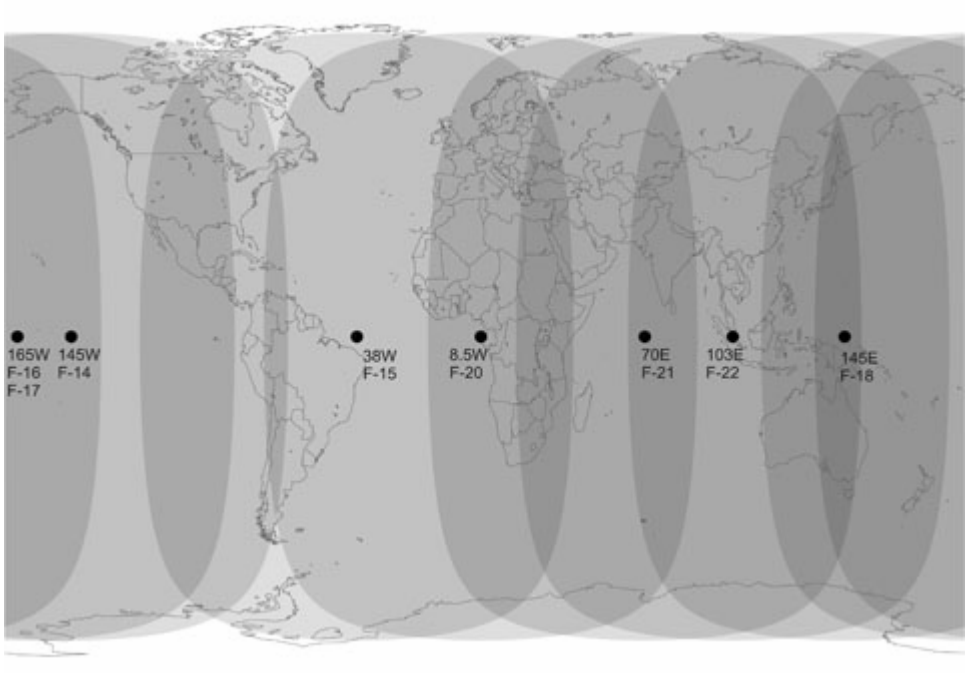

Figure 8. U.S. Early Warning Satellites and their Coverage Areas[99]

Within a few years the United States is expected to launch the follow-up to DSP satellites, the Space Based Infrared Systems (SBIRS) program. The SBIRS constellation supports user requirements in four distinct mission areas: Missile Warning (MW), Missile Defense (MD), Technical Intelligence (TI) and Battle Space Awareness (BSA).[100] The MW and MD scenarios are depicted in Figure 9.

[99] Pavel Podvig, "Reducing the Risk of an Accidental Launch," http://russianforces.org/podvig/eng/publications/20061000sgs.shtml [Accessed July 31, 2006].

[100] U.S. Air Force, "Space Based Infrared System (SBIRS)," http://www.losangeles.af.mil/SMC/PA/Fact_Sheets/sbirs%20fact%20sheet.pdf [Accessed June 23, 2006].

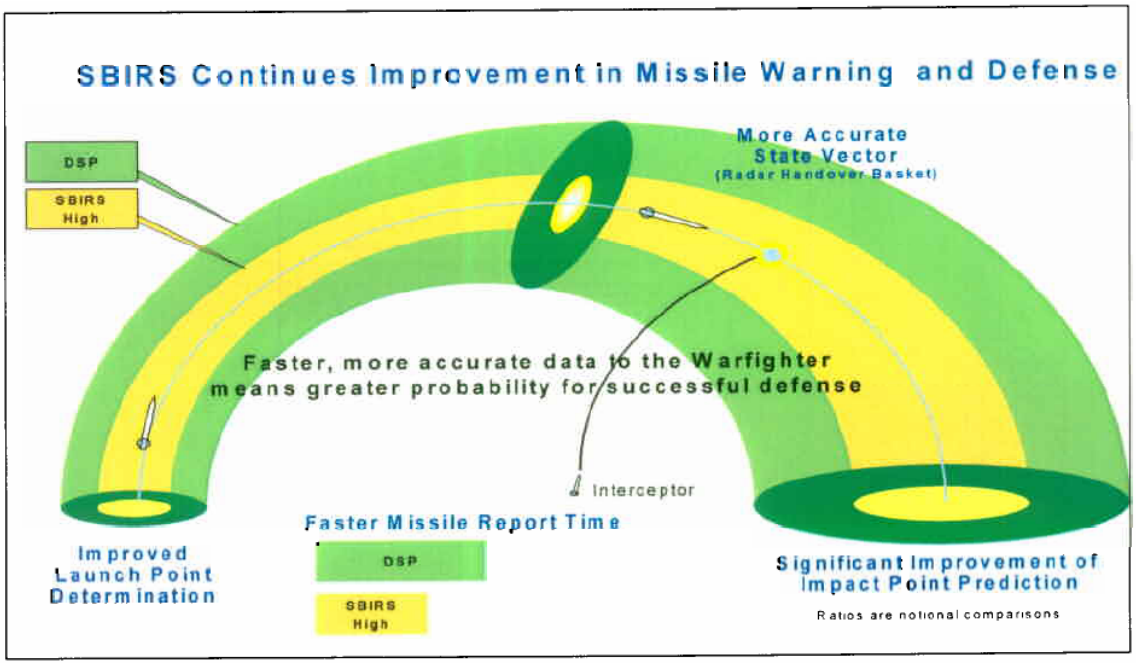

Figure 9. Space based Infrared System (SBIRS) Operation[101]

2. U.S. Early Warning Radars

The mainstay of the U.S. early warning radar system is PAVE PAWS (PAVE is an Air Force program name, while PAWS stands for Phased Array Warning System) and is operated by the 21st Space Wing squadrons for missile warning and space surveillance.[102] The radars are used for detecting and tracking SLBMs and ILBMs. The location of U.S. early warning radars located in the United States, as well as in Flyingdales (UK) and Thule (Greenland), are depicted in Figure 10, along with their area of coverage.

[101] U.S. Air Force, "Space Based Infrared System (SBIRS)."

[102] Ibid.

Figure 10. U.S. Early Warning Radar Network. Size of radar fans may not correspond to radar detection range[103]

The LOW posture of the United States makes stringent demands on the early warning systems as they are the stepping stone for the U.S. command and control cycle. Any false alarm generated by these early warning systems affects the credibility of these systems and sometimes make them unreliable sources. As per the data made available by the American government, a total of 1,152 moderately serious false alarms occurred during the period from 1977 to 1984, an average of almost three false alarms per week.[104] Given the flight time of the missiles between India and its present adversaries, it is not prudent to spend money on early warning systems designed for nuclear command and control system. An efficient surveillance system should meet the demands of an Indian nuclear command and control system.

[103] Podvig, *Reducing the Risk*.

[104] The Center for Defense Information, "Accidental Nuclear War: A Rising Risk?" *The Defense Monitor* 15, no.7 (1986).

E. COMMUNICATION NETWORKS

The U.S. communications network for nuclear command and control includes a host of communication links including landlines, laser, satellite, and radio communications. The communication links are depicted in Figure 7.

1. Minimum Essential Emergency Communications Network (MEECN)

The Minimum Essential Emergency Communications Network (MEECN) provides secure, high fidelity, jam resistant and survivable communications link between the NCA [president] and the strategic nuclear forces throughout all phases of strategic conflict.[105] The MEECN is the replacement for the outdated Ground Wave Emergency Network (GWEN). The updated MEECN has the following projects:

a. Defense IEMATS Replacement Command and Control Terminal (DIRECT)

The Defense Improved Emergency Message Automated Transmission System (IEMATS) Replacement Command and Control Terminal (DIRECT) allows the CJCS and warfighters to remain responsive to NCA [president] by providing an automatic capability to prepare, process, transmit, receive, acknowledge, and re-address EAMs on available communication channels.[106]

b. ICBM LCC EHF System (ILES)

The Extremely High Frequency (EHF) project will provide a modernized receive/transmit EHF link from the NCA to the ICBM LCCs.[107]

c. Modified Miniature Receive Terminal (MMRT)

The Miniature Terminal provides the NCA and nuclear CINCs [Combatant Commanders] with survival C2 link to B-1 and B-52 bombers at the positive control turn around point (PCTAP) for EAM communications.[108]

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[105] Federation of American Scientists, "Minimum Essential Emergency Communications Network," http://fas.org/nuke/guide/usa/c3i/meecn.htm [Accessed June 14, 2006].

[106] Federation of American Scientists, "Defense IEMATS Replacement Command and Control Terminal," http://fas.org/nuke/guide/usa/c3i/direct.htm [Accessed June 14, 2006].

[107] Federation of American Scientists, "Minimum Essential Emergency."

[108] Ibid.

2. Satellite Communications

U.S. nuclear command and control is heavily dependent on satellite communications. U.S. satellite communications can be divided according to their operation in various frequency bands. U.S. military satellites along with their frequencies of operation are depicted in Figure 11.

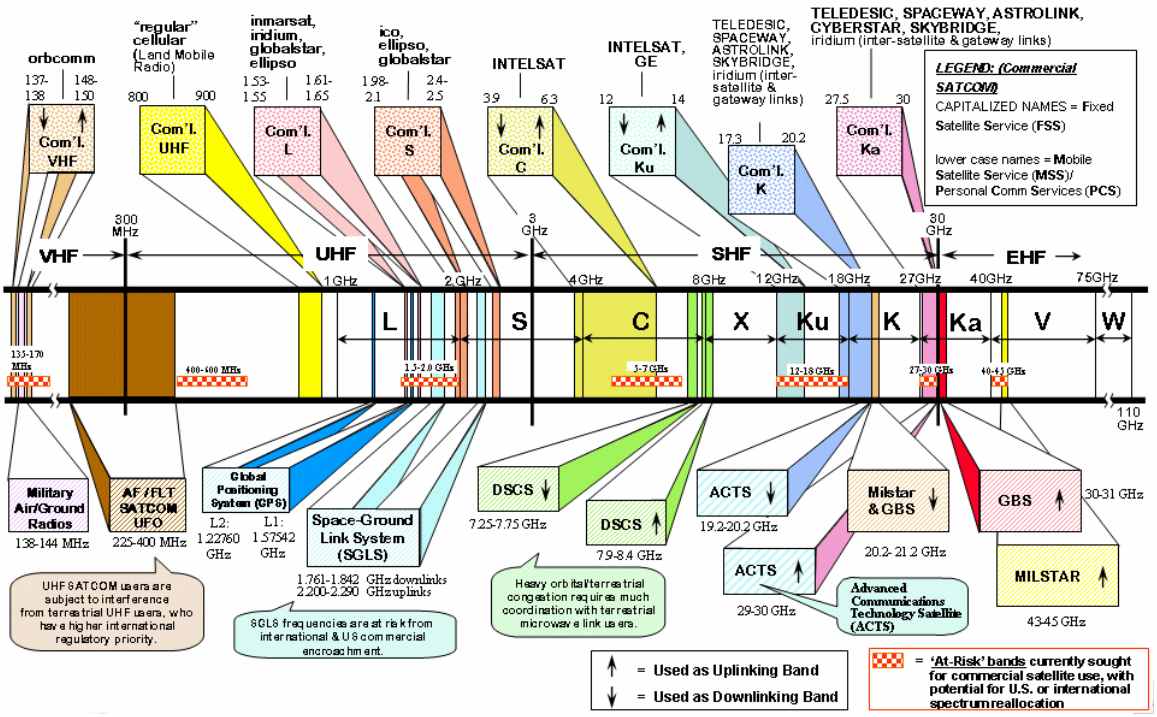

Figure 11. U.S. Satellites along with their Operating Frequencies[109]

a. UHF Satellite Communications

UHF is available worldwide through the Fleet satellite Communications System (FLTSATCOM) through the current UHF Follow-On (UFO) satellites and they in addition carry several UHF payloads like the Air Force Satellite Communications System

109 GlobalSecurity.org, "Satellite Bandwidth," http://www.globalsecurity.org/space/systems/bandwidth.htm [Accessed June 18, 2006].

(AFSATCOM) that provide SATCOM for strategic users.[110] The UHF satellites have less bandwidth capabilities as compared to the SHF and EHF satellites. The Submarine Satellite Information Exchange Subsystem (SSIXS) complements the terrestrial VLF and MF/HF communication links between shore-based submarine Broadcast Authorities (BCAs) and submarines by providing the capability to receive messages transmitted via satellite at scheduled intervals ("Group Broadcasts").[111]

b. SHF Satellite Communications

The satellites from Defense Satellite Communications System (DSCS) Phase III provide worldwide secure voice and high data communications, and they also carry a single channel transponder used for disseminating EAM and Force Direction Messages (FDMs) to nuclear capable forces.[112] The satellites from DSCS are currently the bastion for U.S. worldwide satellite communications. The next generation Wideband Gapfiller Satellites (WGS), scheduled to be launched in 2006, can route 2.4 to 3.4 Gbps of data - providing more than 10 times the communications capacity of the predecessor DSCS III satellite.[113]

c. EHF Satellite Communications

The Military, Strategic, Tactical and Relay (MILSTAR) satellite communications system is a secure nuclear-survivable, space-based communication system that provides the President, Secretary of Defense and the U.S. Armed Forces with assured, survivable satellite communications with low probability of interception and detection.[114] The Milstar system has three projects: Milstar I, Milstar II and Advanced EHF Satellite (the follow-on satellite system). The Advanced EHF (AEHF) satellite

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[110] Federation of American Scientists, "Satellite Communications for the War fighter MILSATCOM Handbook Vol.1," http://www.fas.org/spp/military/program/com/docs/lsn4app1.htm [Accessed June 12, 2006].

[111] GlobalSecurity.org, "FLEETSATCOM Operations," http://www.globalsecurity.org/space/systems/fleet_ops.htm [Accessed June 24, 2006].

[112] U.S. Air Force, "Defense Satellite Communications System Phase III," http://www.losangeles.af.mil/SMC/PA/Fact_Sheets/dscs_fs.htm [Accessed June 12, 2006].

[113] Boeing, "Transformational Wideband Communication Capabilities for the Warfighter," *Integrated Defense Systems, Satellite Development Center*, http://www.boeing.com/defense-space/space/bss/factsheets/702/wgs/wgs_factsheet.html [Accessed June 14, 2006].

[114] U.S. Air Force, "Milstar System," *MILSATCOM*, http://www.losangeles.af.mil/smc/MC/Milstar.htm [Accessed June 14, 2006].

system will allow the National Security Council and Unified Combatant Commanders to control their tactical and strategic forces at all levels of conflict through nuclear war and supports the attainment of information superiority with a capability ranging from 75 bps to 8 Mbps.[115]

3. Submarine Communications

The communications with submarines capable of launching SLBMs is mainly maintained through connectivity links of ELF, VLF and TACAMO airborne VLF communication systems.

a. ELF Communications

The U.S. Navy's ELF Communication transmitter featuring 90 Km wires is installed at KI Sawyer Air Force Base in Michigan.[116] The ELF is capable of penetrating deeper into sea water than VLF transmissions but has the disadvantage of very low bandwidth. At a data rate of one bit per minute, compact encoded messages signifying orders like "Sub number 20: ascend to VLF depth to receive another message" could be transmitted in about ten minutes.[117]

b. VLF Communications

The U.S. Navy's shore VLF/LF transmitter facilities transmit a 50 baud submarine command and control broadcast which is the backbone of the submarine broadcast system.[118] The sea water penetrating capability of VLF is only to a depth of few meters. To receive the teletype broadcast, the submarine must deploy a length of antenna within the upper 10 meters or so of the ocean where the VLF waves penetrate.[119] The U.S. operates several VLF/LF transmitters across the globe as depicted in Figure 12.

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[115] U.S. Air Force, "Advanced Extremely High Frequency (AEHF) Satellite System," *MILSATCOM*, http://www.losangeles.af.mil/smc/MC/aehf.htm [Accessed June 23, 2006].

[116] John Pike, "Extremely Low Frequency Communications Program," http://fas.org/nuke/guide/usa/c3i/elf.htm [Accessed June 19, 2006].

[117] Ashton B. Carter, "Communications Technologies and Vulnerabilities," in *Managing Nuclear Operations*, ed. Ashton B. Carter, John D. Steinbruner and Charles A. Zraket, (The Brookings Institution, 1987), 236.

[118] Federation of American Scientists, "Very Low Frequency," http://fas.org/nuke/guide/usa/c3i/vlf.htm [Accessed June 26, 2006].

[119] Carter, "Communications Technologies," 237.

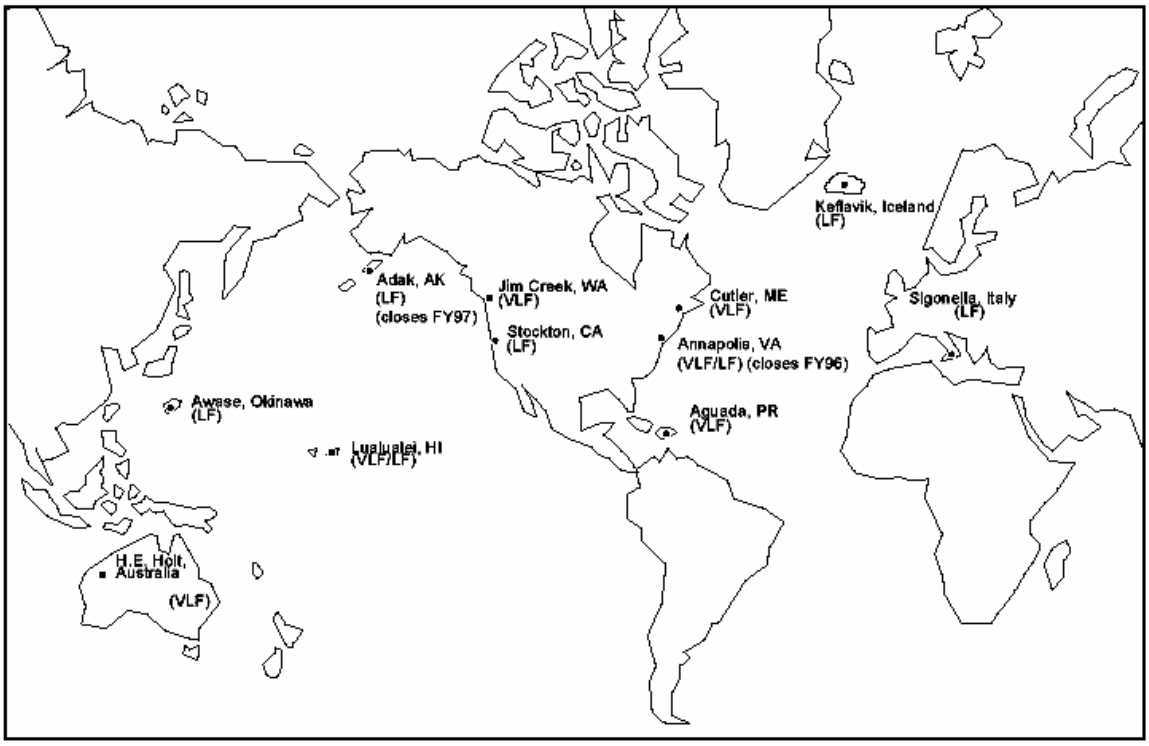

Figure 12. U.S. VLF/LF Site Locations[120]

c. TACAMO Aircraft

The E-6B modified and E-6A carries the Take Charge and Move Out (TACAMO) communication system used for VLF communication with the fleet ballistic missile submarine force.[121] The aircraft trail a long wire and maneuver in space such that the wire remains vertical. The VLF communication using TACAMO is depicted in Figure 13. One TACAMO is always airborne over the Atlantic and one over the Pacific. In case a nuclear attack destroyed the shore antennas, TACAMO could deploy its several-

[120] Federation of American Scientists, "Very Low Frequency."

[121] Federation of American Scientists, "E-6Mercury (TACAMO)," http://fas.org/nuke/guide/usa/c3i/e-6.htm [Accessed June 21, 2006].

mile-long trailing wire antenna and relay the EAM from the higher authority to the submarines.[122]

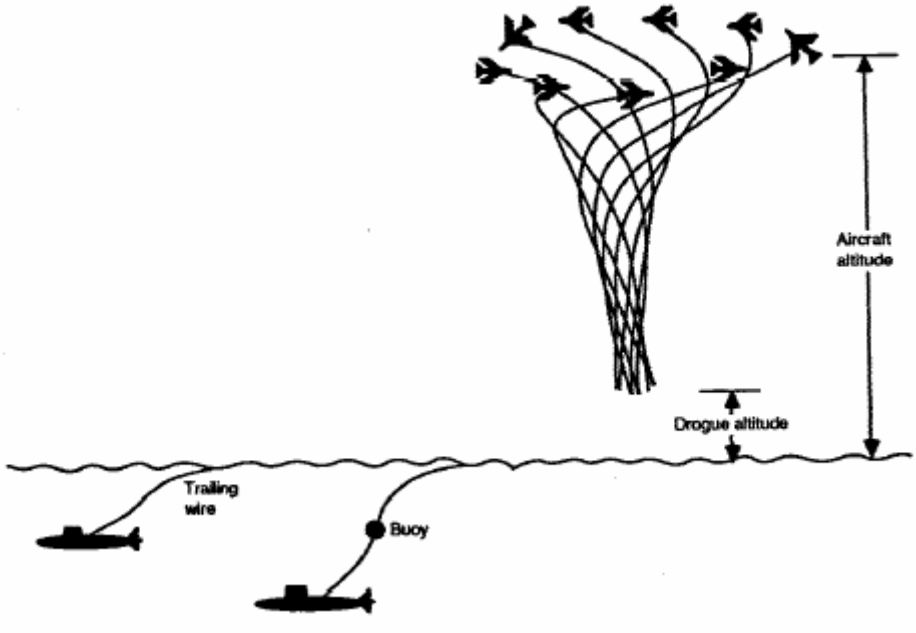

Figure 13. VLF Trailing Wire Antenna aboard TACAMO Relay Aircraft Broadcasting to U.S. Missile Submarines[123]

4. National Communications System (NCS)

The National Communications System (NCS) was established in 1963 following the Cuban Missile Crisis. It consists of 23 member organizations tasked with ensuring that the Federal Government has the Necessary communications under all conditions from normal situations to national emergencies and international crises.[124]

5. Future Programs

Future U.S. communications programs are conceptualized to stay abreast with the emerging demands of communication and information sharing.

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[122] Carter, "Communications Technologies," 237.

[123] Carter, "Communications Technologies," 238.

[124] Federation of American Scientists, "National Communications System (NCS)," http://fas.org/nuke/guide/usa/c3i/ncs.htm [Accessed June 12, 2006].

a. Global Information Grid-Bandwidth Expansion (GIG-BE)

The USSTRATCOM is overseeing the development of Global Information Grid-Bandwidth Expansion (GIG-BE) which will unleash the U.S. military organizations from the currently faced bandwidth constraint during their day-to-day operations. The GIG-BE will use an advanced fiber optic backbone and switching technology to upgrade telecommunications lines at DOD critical installations, and provide networked services with unprecedented bandwidth to operating forces and operational support activities (approximately 1,000 times the current capacity to critical DOD sites).[125]

b. Transformational Communications Satellite (TSAT)

The TSAT will be helpful in the areas where the coverage by optical fiber is not possible. In essence, the TSAT will extend the network's full capabilities to mobile and tactical users and will incorporate Internet protocol and laser communications capabilities into the Defense Department's satellite communications constellation.[126]

Communications are the crux of a nuclear command and control system. During crisis and war, communications do break down and therefore it is necessary to have alternate sources of communications. The United States has a host of communications networks for nuclear command and control including satellite, radio, optical fiber and others. The Indian nuclear command and control system should also be based on a multitude of communications network so as to provide secure communications even after absorbing the first strike.

F. U.S. TECHNICAL AIDS FOR COMMAND AND CONTROL

Apart from the procedural aspects, the technical aids play a major role in U.S. nuclear command and control.

1. Global Command and Control System (GCCS)

The Global Command and Control System (GCCS) is an automated information system designed to support deliberate and crisis planning with the use of an integrated set

[125] John P. Stenbit, "Moving Power to the Edge," *CHIPS-The Department of the Navy Information Technology Magazine*, Summer 2003.

[126] Ibid.

of analytic tools and flexible data transfer capabilities.[127] The GCCS has replaced the Worldwide Military Command and Control System (WWMCCS) which was unable to provide effective command and control to the growing demand of the U.S. military. The GCCS is a Common Operating Environment (COE), integration standard, and migration strategy that eliminate the need for inflexible stovepipe command and control systems and expensive duplication.[128]

2. Strategic Automated Command Control System (SACCS)

The Strategic Automated Command Control System (SACCS) network is the primary network for the transmission of EAM to the war fighting commanders in the field in not more than 15 seconds and is located in the CINCSTART [Commander USSTRATCOM] command post, strategic command centers, missile launch control centers, and at strategic aircraft sites.[129]

3. Strategic War Planning System (SWPS)

The Strategic War Planning System (SWPS) supports USSTRATCOM to develop, verify and produce the Single Integrated Operations Plan (SIOP) – the nation's strategic war fighting plan and related products.[130]

4. Nuclear Planning and Execution System (NPES)

The Nuclear Planning and Execution System (NPES) is a command and control Automated Data Processing (ADP) system intended to support information analysis and decision making during peacetime and crises involving strategic nuclear operations by proving timely force status information and residue capability data.[131]

5. Submarine Satellite Information Exchange Subsystem (SSIXS)

The submarine satellite Information Exchange Subsystem (SSIXS) is a UHF system that provides the submarine's commander with the capability to exchange

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[127] John Pike, "Global Command and Control (GCCS)," *Federation of American Scientists*, http://fas.org/nuke/guide/usa/c3i/gccs.htm [Accessed June 14, 2006].

[128] Pike, "Global Command."

[129] Federation of American Scientists, "Strategic Automated Command Control System (SACCS)," http://fas.org/nuke/guide/usa/c3i/saccs.htm [Accessed June 12, 2006].

[130] Federation of American Scientists, "Strategic War Planning System (SWPS)," http://fas.org/nuke/guide/usa/c3i/swps.htm [Accessed June 12, 2006].

[131] Federation of American Scientists, "Nuclear Planning and Execution System (NPES)," http://fas.org/nuke/guide/usa/c3i/npes.htm [Accessed June 12, 2006].

encrypted general-service and special-interest text message traffic between SSNs and SSBNs and the shore Broadcast Control Authorities (BCAs).[132]

The disposition of a large number of nuclear weapons around the world by the United States ensured the development of a number of technical aids for controlling its nuclear operations. Many of the systems employed by the United States as technical aids for controlling a nuclear arsenal are superfluous in the Indian context. But the most important system for India would be the control system for transmission and reception of Indian EAMs.

G. U.S. COMMAND AND CONTROL SYSTEM VULNERABILITIES

The nuclear command and control system is the most important and critical component in nuclear operations. Today the U.S. nuclear strategy is based on deterrence by punishment and deterrence by denial; therefore it is essential that it has survival capabilities against a first strike. The relationship between command system survivalibility and deterrence depends on the attacker's confidence in its devastating and successful first strike. The command vulnerability has virtually dictated a philosophy of early use and the U.S. posture was geared to launch on warning long before the problem of Minuteman vulnerability drew attention to it.[133] Survivability needs to be attained in terms of command authorities, C4I, and the delivery systems which are akin to the brain, nervous system, and arms in human anatomy, respectively. The survivability of the U.S. delivery systems, which is based on the triad of ICBMs, bombers, and SLBMs, figures after the survivability of the command authorities and the C4I systems. The question about absolute non-survivability of command authority, C4I systems and delivery systems after a massive nuclear first strike on the United States is meager. The U.S. C3I is the central nervous system of its strategic forces and the Soviets [former opponents] would almost certainly attack the U.S. C3I installations for several reasons:

- To degrade U.S. capabilities to retaliate.
- To decapitate U.S. forces and deprive them of military leadership.

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[132] Federation of American Scientists, "Submarine Satellite Information Excahange Subsystem (SSIXS)," http://fas.org/nuke/guide/usa/c3i/ssixs.htm [Accessed June 12, 2006].

[133] Blair, *Strategic Command*, 285.

- To degrade U.S. air defense capabilities and facilitate penetration by Soviet [opponent] bombers and ALCMs.
- To degrade U.S. capabilities to wage protracted nuclear war.[134]

In this part of the chapter, the focus is on the vulnerabilities associated in a decapitating attack against the command authorities (political and military leadership) and the C4I systems which are essential components of the command and control system. The survival of the delivery system is less of a problem as the nuclear retaliatory strike is based on a triad in which the submarines have very high survival capabilities. The United States does not have a strategic command system that could survive deliberate attack and even 50 nuclear weapons are probably sufficient to eliminate the ability to direct U.S. strategic forces to coherent purposes.[135] Vulnerability is not only a function of one's own capabilities to defend against a first strike, but it is also dependent on the capabilities of the opponent. The end of the Cold War has certainly reduced the tensions between the United States and Russia. But Russia still remains the only country capable of making a decapitating strike against the United States. Russia has about 3,500 nuclear warheads capable of reaching the continental United States; by comparison, China has only 18 single-warhead missiles that can reach the U.S. homeland.[136] A high confidence technical solution to command system vulnerability probably cannot be achieved at a feasible cost;[137] nevertheless, it is worthwhile to see the steps taken by the U.S. to mitigate command vulnerabilities.

1. Vulnerability of National Command Authorities

The U.S. government has promulgated a list of successors to the President of the U.S. in case the President dies during a nuclear attack. The problem is aggravated as most of these successors also work in the Washington D.C. area. Chances are high that they would also be killed during the nuclear attack, and it will be very difficult to ascertain who is in charge. The U.S. government has delegated the Federal Emergency

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[134] Peter V. Pry, *The Strategic Nuclear Balance Volume2: Nuclear Wars: Exchanges and Outcomes*, (Crane Russak, 1990), 17.

[135] John D. Steinbruner, "Nuclear Decapitation," *Foreign Policy*, no.45 (Winter, 1981-82), 16-28.

[136] Keir A. Lieber and Daryl G. Press, "The End of MAD?" *International Security* 30, no. 4 (Spring 2006): 8.

[137] Steinbruner, "Nuclear Decapitation," 16-28.

Management Agency (FEMA) as the authenticating agency. FEMA keeps a daily tab on the whereabouts of the President and his 16 successors and is also responsible for briefing presidential successors on plans for their dispersal during attack and on procedures for reporting their locations at all times.[138] As mentioned earlier a surprise nuclear attack against United States is not likely, and therefore during the development of a crisis FEMA would have taken adequate measures regarding dispersal of the presidential successors. After the 9/11 attacks, the President was taken to the strategic forces headquarters and the Vice President was whisked away to a secret location and was in constant touch with the President and other members of the National Security Council through safe and uninterruptible communication channels.[139]

2. Vulnerability of C4I Systems

The vulnerability of U.S. C4I is two-fold, namely physical destruction and communications disruption because of physical destruction or through Electromagnetic Pulse (EMP) attacks.

a. Physical Destruction

The U.S. C4I systems are vulnerable to nuclear attacks as it would physically destroy the command centers including airborne and mobile, communications centers such as EHF and VLF transmitters, early warning and communications satellites, satellite control centers, ICBMs LCCs and others associated with the U.S. nuclear command and control system. The physical destruction of these sites mentioned above can be prevented by active and passive measures. The active means of defense started in the form of Strategic Defense Initiate (SDI) in the 1980s by President Ronald Reagan, and today it has taken the shape of Ballistic Missile Defense (BMD). The passive defense can be achieved through concealment and mobility. The concealment of fixed sites is achieved by physically hardening the sites and also has redundancy developed in the system to cater for vulnerabilities associated with C4I systems. None of the C4I assets are hardened enough to withstand the nuclear attack.[140] But, as seen earlier, all the major

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[138] Barry R. Schneider, "Invitation to a Nuclear Beheading," in *The Nuclear Reader: Strategy, Weapons, War*, ed. Charles W. Kegley, Jr. and Eugene R. Wittkopf, (St. Martin's Press, 1985), 281.

[139] K. Subrahmanyam, "Essence of Deterrence," *Times of India*, January 07, 2003.

[140] Pry, *Strategic Nuclear Balance*.

command and communications centers have substantial redundancy in the form of alternate, airborne and mobile facilities.

The U.S. nuclear command and control system is highly dependent on satellites which provide early warning and communications. The physical destruction of satellites using Anti Satellite weapons (ASAT) is difficult to achieve, and moreover the idea is averse to Russia and China, the two potential adversaries.[141] The physical attack on the satellite control terminals and jamming of the data and control links is a more lucrative and achievable path. A number of measures have been taken to protect the satellites against jamming including spread spectrum techniques, switching to anti-jam mode, using directional antennas, error correcting codes and many others.

b. Communication Disruption by Physical Destruction or by Electromagnetic Pulse (EMP) Attacks

The fixed command and communications centers which are not hardened enough are the most vulnerable sites to a nuclear attack as they will be physically destroyed if the attack is successful (i.e., it has not been intercepted by active means such as BMD). On the other hand, the mobile communication centers and the mobile satellite terminals are hard to target if they are concealed efficiently. However, their performance will degrade if they are on transit. The Airborne command centers are impractical to attack with ballistic missiles even if tracked continuously, since they travel hundreds of miles in the half-hour flight time of an ICBM.[142]

The effects of various EMP attacks are as follows:

- A High Altitude EMP (HEMP) explosion above an altitude of 40 Km radiates radio waves of potentially harmful intensity.
- The System Generated EMP (SGEMP) generates EMP within the body of a satellite by radiation from a distant detonation in space.
- The Source Region EMP (SREMP) occurs in the immediate vicinity of a nuclear burst within the atmosphere and is important only for targets designed to withstand nearby bursts, such as antennas serving ICBM silos and radars for some ballistic missile defenses. [143]

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[141] The Eisenhower Institute, "Weapons in Space," http://www.eisenhowerinstitute.org/programs/globalpartnerships/fos/newfrontier/jointworkingpaper5-28-02.htm [Accessed June 13, 2006].

[142] Carter, "Communications Technologies," 258.

[143] Ibid., 273.

The waveform summary of an EMP attack is tabulated in Table 7.

Type	Peak amplitude	Timeframe
HEMP	50 kV/m	Few nanosec to 200 nanosec
Surface-burst		
Source region	1 MV/m	Few nanosec to 1 microsec
	10 kV/m	1 microsec to 0.1 sec
Radiated region	10 kV/m	1 microsec to 100 microsec
Air-burst		
Source region	Similar to surface-burst	
Radiated region	300 V/m at 5 km, typical (highly dependent on HOB	10 nanosec to 5 microsec
SGEMP	100 kV/m	Few nanosec to 100 nanosec
MHD-EMP	30 V/km	0.1 sec to 100 sec

Table 7. EMP Waveform Summary[144]

To harden against EMP is very challenging as it is almost impossible to completely harden a site. But certainly a lot of work has been done to achieve HEMP hardness and the United States has been the world leader in HEMP technology since the first article appeared in the early 1960s.[145] The EMP hardening approaches are encasing critical electronics in a sealed conducting box, inserting "surge arresters", designing more

[144] Federation of American Scientists, "Engineering and Design Electromagnetic Pulse (EMP) and Tempest Protection for Facilities," Publication Number EP1110-3-2, December 31, 1990, http://fas.org/nuke/intro/nuke/emp/c-2fig.pdf [Accessed June 12, 2006].

[145] Federation of American Scientists, "Nuclear Weapons Effects Technology, Military Critical Technologies List (MCTL) Part II: Weapons of Mass Destruction," http://fas.org/irp/threat/mctl98-2/p2sec06.pdf [Accessed June 14, 2006]

rugged electronic circuits and programming computers to restart themselves if they suffer transient disruption.[146]

The United States are pioneers in the field of passive and active defenses against an incoming missile attack. These efforts are admirable as they reduce the vulnerabilities associated with a decapitating first strike. In view of its NFU policy, a first strike against India by China or Pakistan is going to be a decisive blow in view of the presumably small number of nuclear arsenals and command and control facilities available in India. Therefore, India should consider all the measures taken by the United States such as alternate command authorities, alternate command centers, hardening of missile silos and command centers against EMP attacks and creating India's own National Missile Defense system.

H. EFFECTIVENESS OF U.S. NEGATIVE CONTROL

Under normal peacetime circumstances, strategic forces and supporting C3I systems follow routines that maintain negative control, which is defined as the prevention of an accidental or unauthorized launch of nuclear weapons.[147] The aim of negative control is to prevent inadvertent war through strict assertive control. The positive control on the other hand is the transmission of deliberate and effective instructions to undertake strategic attacks.[148] A decapitation attack which is a threat to positive control, forces the national leaders to delegate authority during a major crisis. The positive and negative controls are diametrically opposite requirements in a command and control system which is essential for conducting nuclear operations. Therefore a fine balance is to be maintained for protection against decapitation and against unwanted use of nuclear weapons. This can be achieved through technical and organizational means which have to be incorporated into the command and control system.

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[146] Carter, "Communications Technologies," 277.

[147] Steinbruner, "Nuclear Decapitation," 23.

[148] Ibid., 24.

The oversight of the DOD nuclear surety program[149] is provided by Deputy Assistant to the Secretary of Defense for Nuclear Matters, DATSD (NM). The standards which the DATSD (NM) maintains as part of its operation are depicted in Figure 14.

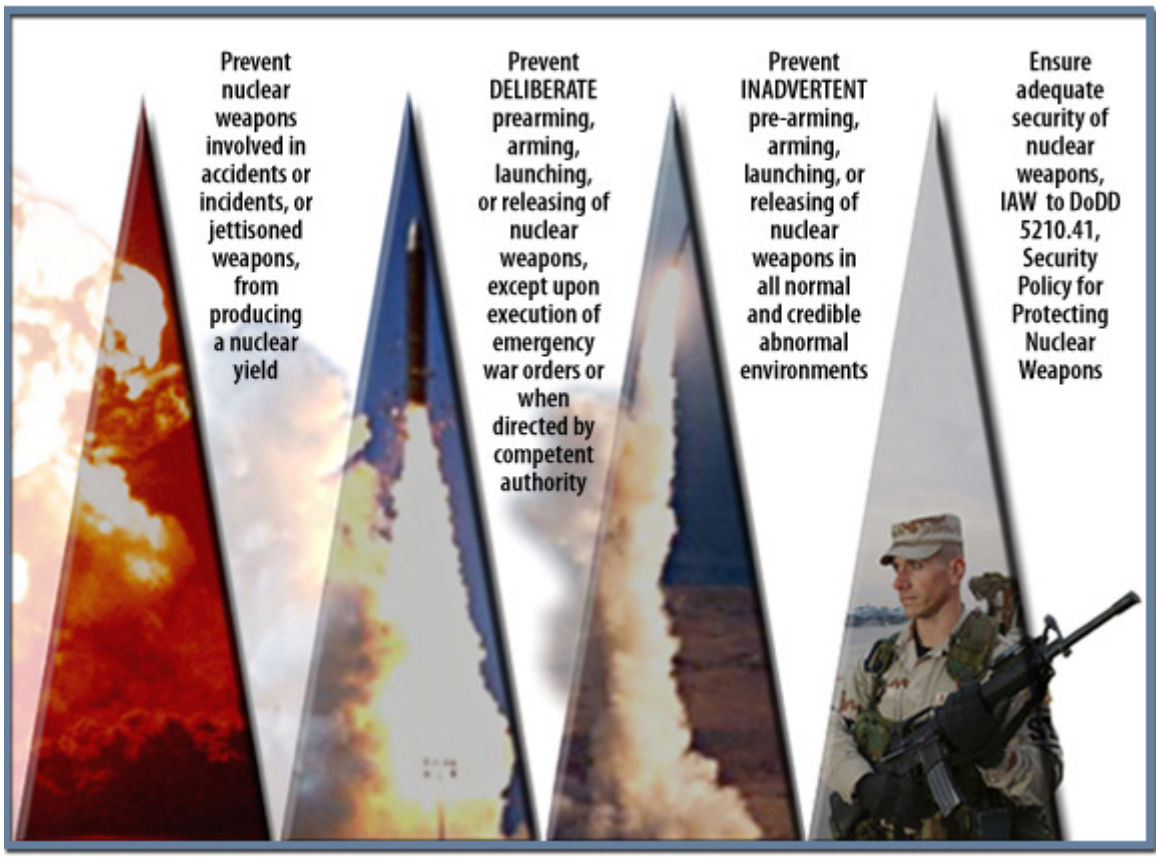

Figure 14. DOD Nuclear Weapon System Safety Standards[150]

An effective negative control of the U.S. nuclear weapons is maintained through the following technical and operational measures:

1. Permissive Action Links (PALs)

The permissive action links provide the authorities with the ability to achieve "use control" by decoupling control of the weapon from the possession of the weapon.[151]

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[149] Office of the Deputy Assistant to the Secretary of Defense for Nuclear Matters, "Nuclear Weapons Surety," http://www.acq.osd.mil/ncbdp/nm/nuclearweaponssurety.html [Accessed June 16, 2006]. Nuclear Weapons Surety is the material, personnel and procedures that contribute to the safety, security, reliability and control of nuclear weapons, thus assuring no nuclear accidents, incidents, unauthorized use or degradation in performance.

[150] Ibid.

[151] Donald R. Cotter, "Peacetime Operations Safety and Security," in *Managing Nuclear Operations*, ed. Ashton B. Carter, John D. Steinbruner and Charles A. Zraket, (The Brookings Institution, 1987), 46.

PALs are codes for arming circuits of the weapon which prevent it from being armed until [a] proper[ly] authorized enabling code is inserted.[152]

The U.S. command and control system involves two types of codes, authenticating (EAMs) and Enabling (PAL), and it is likely that whoever holds the enabling codes is also in the chain of command that will transmit the order containing the authorizing codes down to the executing officer.[153] The effectiveness of PALs is limited by the code management system and is given high priority in the United States.

The warheads of SLBMs do not have PALs and the launch is authorized through a Navy nuclear weapons surety program in which the receipt of the launch message is verified by two officers and the launch process involves most of the crew.[154]

2. Personnel Reliability Program (PRP)

The PRP identifies personnel who are reliable for performing duties associated with nuclear operations. Only those personnel who have demonstrated the highest degree of individual reliability for allegiance, trustworthiness, conduct, behavior, and responsibility are allowed to perform duties associated with nuclear weapons, and they are evaluated continuously for adherence to PRP standards.[155]

3. Two-Man Rule

The two-man rule control concept led to elaborate systems for launch control of ICBM and SLBM strategic missiles and requires every sensitive action taken with nuclear weapons to be accomplished by two people with the same training and authority.[156]

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[152] Ibid., 49.

[153] Feaver, *Guarding the Guardians*, 38.

[154] Cotter, "Peacetime Operations," 52.

[155] U.S. Department of Defense, "Nuclear Weapons Personnel Reliability Program (PRP)," Directive Number 5210.42, January 8, 2001, http://www.dtic.mil/whs/directives/corres/pdf/d521042_010801/d521042p.pdf [Accessed June 27, 2006].

[156] Cotter, "Peacetime Operations," 50.

4. Code Management

The National Security Agency (NSA) is in charge of distributing the daily launch codes to the White House, Pentagon, STRATCOM and the TACAMO aircraft.[157] It is presumed that the NSA provides the authenticating (EAMs) as well as enabling (PALs) codes.

The effectiveness of negative control in a democratic society needs no emphasis. India should adopt all the measures mentioned above by the United States in order to bolster its own effectiveness of negative control.

I. U.S. CIVIL-MILITARY RELATIONS

The civil-military relations play an important role in the nuclear command and control system of a country as it determines the disposition of the system by defining as delegative or assertive control. In the United States, civil-military relations have been healthy with a professional military which has remained subordinated to civilian control. However, it does not imply that the United States was bereft of civil-military conflicts over the control of nuclear operations.[158] There was a continuous rift over the control issues of nuclear operations where the civilians preferred assertive control and the military wanted delegative control. Despite a pronounced preference for assertive control, however, civilian leaders have actually tolerated a relatively high degree of delegation in the nuclear command and control system, to make the system more survivable or the deterrent more credible.[159] It was presumed that the delegative control was necessary for a decapitative strike by the Soviets. In some aspects, the United States tolerated more delegative control than the Soviet Union did, even given comparable strategic situations.[160] During the Cold War, the SLBM capable submarines were deployed without PALs and they remained an extreme example of delegative control. However, the NPR 2001 eliminates Peacekeeper ICBMs, removes 4 Trident SSBNs from strategic

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[157] Yarynich, *Nuclear Command*, 182.

[158] Feaver, *Guarding the Guardians*.

[159] Peter D. Feaver, "Command and Control in Emerging Nuclear Nations," International Security 17 vol.3 (Winter 1992/93), 175

[160] Ibid

service, and downloads weapons from Trident SLBMs, Minuteman III ICBMs, and B-52H and B-2 bombers.[161] These reductions and downloading of weapons pave a new path for assertive control post Cold War.

The strategic threat to India does not warrant a delegative control and an assertive control should support the requirements from a strategic perspective.

J. FINANCIAL IMPLICATIONS

The cost of nuclear operations can be divided into three categories: the manufacture and maintenance of a nuclear arsenal, delivery platforms, and the command and control systems. The estimates of U.S. expenditures in these three categories (in constant 1996 dollars) are included in Table 8.

Building the Bomb			**Deploying the Bomb**			**Targeting & Controlling the Bomb**		
Purpose	%	$ Value (billions)	Purpose	%	$ Value (billions)	Purpose	%	$ Value (billions)
Manhattan Engineer District	6.3	25.6	Strategic Offensive Forces	61.1	1980	Strategic Command, Control & Communications	21.9	182
Fissile Materials Production	40.4	165.5	Tactical Offensive Forces	37	1200	Intelligence	60.2	500
Research, Development, Testing and Weapon Production	42.6	174.6	DoD Warhead Transportation	0.1	3	Continuity of Government Bunkers	1.3	10.8
DoD development and Testing	9.1	37.4	Aircraft Nuclear Propulsion	0.2	7	Space Shuttle & Space Support	3.1	26
Others	1.6	6.3	Naval Nuclear Propulsion	1.6	51	Others	13.5	112.3
Total	100	409.4	Total	100	3241	Total	100	831.1
Total $ 4481.5 Billions								

Table 8. Cost of United States Nuclear Operations[162]

[161]Donald H. Rumsfeld, Secretary of Defense, "Annual Report to the President and the Congress," http://www.dod.gov/execsec/adr2002/pdf_files/chap7.pdf [Accessed July 14, 2006]

[162] Stephen I. Schwartz, ed., Atomic Audit, The Cost and Consequences of U.S. Nuclear Weapons Since 1940(Washington D.C.: Brookings Institution Press,1998) 1-196.

The deployment of strategic forces includes the cost incurred on the non-nuclear platforms as most of the delivery vehicles would have dual purposes. A careful analysis of the data in Table 8 shows that targeting and controlling the bomb is approximately nineteen percent of the total expenditure of the United States' nuclear operations. The intelligence share in targeting and controlling the bomb is approximately sixty percent and is clearly the largest contributor towards expenditure incurred on nuclear command and control. In the case of India, the early warning systems are not envisaged and hence the strategic command, control and communications and continuity of government bunkers would incur the maximum expenditure.

K. CONCLUSION

The command and control system of the United States is an elaborate and robust system which has matured over the years. The nuclear doctrine of the Cold War has been given a new direction by NPR 2001 in which the integration of conventional and strategic forces will take place. With the end of Cold War the U.S. is no longer required to maintain such a vast nuclear command and control system. However, during and after the Cold War the U.S. has maintained a fine balance of positive and negative control through highly advanced technical and organizational measures. The emerging nuclear states can learn a lot from the past experiences of the U.S. and develop a nuclear command and control system to suit their nuclear strategy based on technical and organizational measures sustained by the United States.

The U.S. nuclear command and control system is structured on four basic elements: nuclear doctrine, civil-military relations, technology and finance (see Figure 15). The core of the nuclear command and control system is the nuclear doctrine which caters to the perceived threat. Civil-military relations cater to the organizational set-up for controlling nuclear weapons. Technology assists in catering to the command and control requirements of political and military leadership. The necessary finance is used for setting up this huge command and control system with global reach. The civil-military relations and technical elements provide the necessary political and technical control of the nuclear weapons.

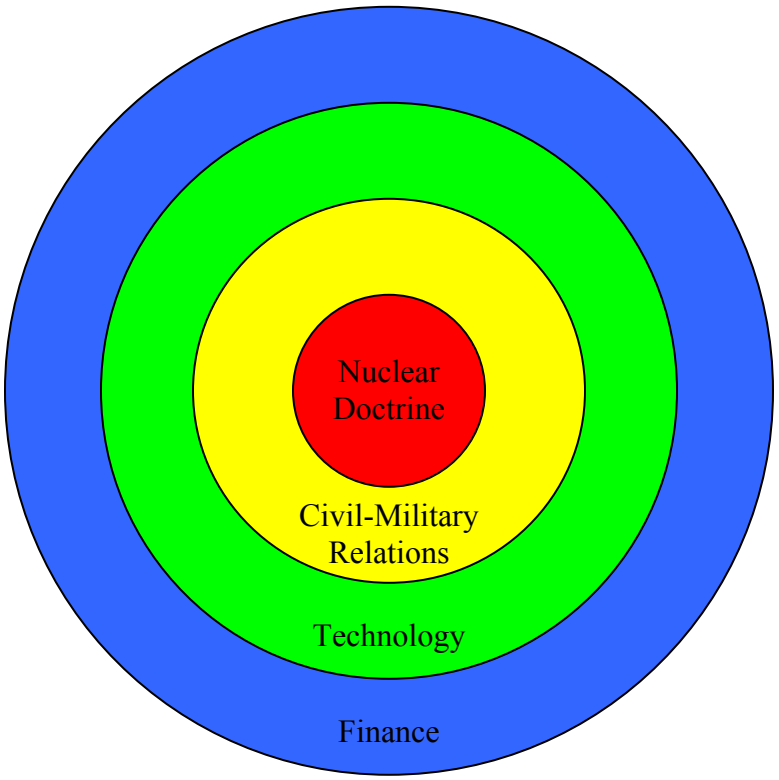

Figure 15. Nuclear Command and Control System Model

The LOW nuclear posture of the United States is incongruous in the Indian context. However, except for the non-relevance of early warning systems in the Indian context, all other constituents of the U.S. nuclear command and control system are highly applicable for an Indian nuclear command and control system. It is pertinent to note here that some of the systems are not required on such an elaborate scale as is the case in U.S. systems, and they include communications network, technical aids required for U.S. global reach, systems for generating SIOP, and some others.

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IV. RECOMMENDATIONS FOR INDIAN NUCLEAR COMMAND AND CONTROL

A. INTRODUCTION

The case study of the nuclear command and control system of the United States implies the necessity for close attention to four aspects: nuclear doctrine, civil-military relations, technology and finance. The first and foremost consideration is nuclear doctrine, which is based on the threat perceived, and determines the nuclear policies and posture of a nuclear weapons state. Civil-military relations and the technology available determine the organizational procedures and technical support to the civilian control of nuclear operations. The financial element encompasses the building and maintenance of the nuclear arsenal, the delivery platforms, and the nuclear command and control systems.

In the Indian context, the promulgated nuclear doctrine is based on NFU, which entails restraint and retaliation only against a nuclear first strike. The adoption of an NFU policy is unique, as none of the declared nuclear weapon states, except China, follow such a declaratory policy. According to former Defense Minister Jaswant Singh, "No other country has debated so carefully and, at times, torturously over the dichotomy between its sovereign security needs and global disarmament instincts, between a moralistic approach and a realistic one, and between a covert nuclear policy and an overt one."[163] The NFU and the de-mated nuclear posture of India simplify its command and control system during peacetime, but pose an equally challenging burden on nuclear operations during crisis and war. The command and custody arrangement of nuclear weapons for India during peacetime demonstrates a low credible deterrent. The mating of nuclear arsenal after a first strike will be a challenging task because the possible lack of political leadership and certain disarray of communication systems will pose an extra burden on the decision-making process. It is then pertinent to find a nuclear posture that suits the NFU policy, is commensurate with the threat perceived, demonstrates "true" credible deterrence, suits the unique Indian civil-military relations, is assertive in control,

[163] Jaswant Singh, "Against Nuclear Apartheid," *Foreign Affairs* 77, no. 5 (September/October 1998).

and last but not least, is financially viable. Without the nuclear command and control system, the nuclear posture would be like having a car with four wheels but without a steering system.

The division of the nuclear command and control system looks simpler to study in the four aspects of nuclear doctrine, civil-military relations, technology, and finance, but it is difficult to formulate a new command and control system under these aspects. This is because there are overlaps in the four aspects mentioned above and many finer details are left out, but these are required at the beginning to set up a complex organization such as a nuclear command and control system.

The formulation of a new command and control system for India can be based on administrative, operational, and technical elements. Civil-military relations and the financial implications are aspects which come under the administrative element. The operational element demonstrates the advocated command and control cycle and would involve civilian leadership, the military and nuclear scientists in various roles associated with the Indian nuclear posture. With the technical elements, India should attain certain technological capabilities to carry out its nuclear operations. The cooperation in technical elements from strategic partners such as the United States could assist India in setting up a robust command and control system. The recommendations for the Indian Nuclear Command and Control System (INCCS) for consideration would be covered under administrative, operational, and technical elements. The assistance from strategic partners and the secondary roles of INCCS are also covered in this chapter.

B. ADMINISTRATION

Any organizational system involving the military can be fabricated with two basic components: administration and operational. This basic bifurcation allows us to put things in the right perspective. The aspects of INCCS, which have no direct connection with the day to day military operation, fall into the domain of administration. It includes and is not restricted to the promulgation of nuclear doctrine, policy, posture, chain of command and designated successors, civilian control over nuclear operations based on civil-military relations, command and control cycle, nuclear signaling, alert status of

nuclear forces and financial aspects of nuclear operations. The administrative elements of INCCS are covered in succeeding sub-paragraphs.

1. Analysis of Draft Indian Nuclear Doctrine

The Draft Nuclear Doctrine (DND) was presented to then Prime Minister Shri A. B. Vajpayee and to the cabinet by the National Security Advisory Board (NSAB) on August 19, 1999, and was subsequently released by the National Security Advisor for public debate. It constituted a major move toward clarifying most of the Indian nuclear issues even though it has not been approved by parliament as yet. The Draft Nuclear Doctrine of India is unique in the sense that it has been promulgated before India had obtained the capabilities mentioned in it.[164] The nuclear doctrine is logically the first step toward building a robust command and control system. The Indian government made the right decision to choose the appropriate nuclear strategy, and as mentioned in the draft doctrine, subsequently planned for building the capabilities mentioned in it. It is prudent here that strategy should drive the technology and not the other way around, because there are huge financial implications to build up a novel command and control system. In order to look at the command and control structure, it is imperative that the Indian nuclear doctrine is carefully analyzed as all the issues of nuclear command and control are derived from it.

a. NFU and its Relevance

Former Prime Minister Atal Behari Vajpayee had declared in a policy statement in parliament on August 4, 1998 that India's nuclear doctrine will be based on the morally justifiable concept of 'No-First-Use' and that India will maintain "a minimum but credible nuclear deterrent."[165] Subsequent to the policy statement by the Prime Minister the proposed nuclear doctrine emerged on a No-First-Use policy and the need to develop a "credible minimum deterrent". An NFU policy has been formulated by the government so that civilians retain affirmative control over nuclear weapons. The Indian NFU retaliation-only nuclear doctrine has been carefully articulated, and it reflects

[164] Mohammed B. Alam, "India's Nuclear Doctrine: Context and Constraints" (working paper no. 11, Heidelberg Papers in South Asia and Comparative Politics, October 2002).

[165] K. Subrahmanyam, "Vajpayee Propounds Nuclear Doctrine," *Times of India*, August 5, 1998.

the maturity and restraint adopted by India which befits India's availability of warning time before any significant military attack by either of its two adversaries, Pakistan or China.

The No-First-Use policy fits well into India's strategic culture. However, it can be claimed that the first use of nuclear weapons is a better form of deterrence, and further, India does not have to justify its second strike capabilities against a decapatative strike by China. The second strike capabilities could be practicable with Pakistan, but India needs to rethink this policy in the case of China. The No-First-Use policy of India is very well crafted, and Indian government remains steadfast on its decision to abide by NFU policy, but a number of factors need to be considered when formulating the nuclear posture based on NFU.

First, the survivability of the nuclear arsenal and the command, control and communication organization after absorbing multiple first strikes from an adversary, especially by China, is a difficult situation to assess. It all depends upon the deception capabilities, number of nuclear weapons, and the robustness of the command and control structure of India. The shock and chaos which will prevail in India after absorbing the nuclear first strike is unimaginable, and the command and control of the limited nuclear arsenal will be in disarray, and the successful weaponization of the nuclear arsenal during these chaotic times could be a big challenge. On the other hand, a crisis situation with China may make it obligatory for the Indian political leaders to pre-delegate the launch authority to military commanders in order to avert a complete annihilation by the 400-odd Chinese nuclear weapons.[166]

Second, an all out bolt-from-the blue attack on India from China is unlikely. But the occupation of the small corridor north of West Bengal, which links central India with its North Eastern states, by the Chinese could compel India to use nuclear weapons on her own soil.

Third, a No-First–Use policy makes sense for India if two of its nuclear adversaries, Pakistan and China, sign a similar multilateral pledge of No-First-Use and

[166] Kanwal, *Nuclear Defence*, 108.

strengthen India's quest for averting a nuclear war in South Asia. It is doubtful that these two countries will come out with a No-First-Use policy with India. The No-First-Use policy of China has diluted over the years which has now reconciled that the No-First-Use does not apply to territories that belong to China, and in this regard China could contemplate the use of nuclear weapons in Arunachal Pradesh in India which China still claims as its own territory.[167] Pakistan, with conventional forces which are inferior in quality and quantity to those of India, is unlikely to embrace the No-First-Use policy. Similarly, the conventional superiority of the Chinese Armed Forces make the No-First-Use pledge by India redundant as a loss of huge territory to the Chinese might force India to use nuclear weapons. It can be safely assumed that a weaker state is unlikely to accept a No-First-Use policy and this pledge by India against China may not be viable.

Fourth, a simultaneous attack on Indian territory by China and Pakistan could be an unmanageable situation for the Indian armed forces, and India would have to rethink its NFU pledge. Though a simultaneous attack by China and Pakistan on Indian soil has not happened in the past, India was concerned about Pakistan's involvement in the Indo-Chinese war in 1962 and the Chinese involvement during the Indo-Pakistan war in 1971.

Fifth, national security and the threat to the state's existence should be the underpinning factor in deciding a nuclear doctrine and the subsequent posture. During the Cold War, in spite of a large number of false alarms and some close quarter situations like the Cuban missile crisis, the two superpowers didn't go the nuclear route besides their policy based on first use.

b. Issue of Credible Deterrence

The second pillar of the Indian draft nuclear doctrine is the pursuance of credible minimum deterrence. The meaning of minimum seems vague: the "minimum" connotes different things for different countries. In order to specify how many minimum nuclear weapons are required to deter Pakistan and China is a very difficult question to answer. To spell out what is minimum is challenging, and according to Mohammad A

[167] Kanwal, *Nuclear Defence*, 65.

Alam what is credible may not be minimal and India may have to adopt a maximalist position in order to maintain deterrence.168

What is strategic deterrence? If we say India deters Pakistan, it means that India fears that Pakistan intends to act against its interests and takes steps to persuade Pakistan that this would be as unwise as it would be unwelcome.[169] In nuclear parlance, deterrence is preventing an adversary from carrying out a nuclear attack through the threat of punishment. The credibility of deterrence depends not only on the actions of the state which is trying to deter, but also on the state which is being deterred. During the Cold War the two superpowers based their deterrence on Mutually Assured Destruction (MAD). In a crisis in the Taiwan straits, the United States would have to consider Chinese nuclear capabilities and would likely handle the situation very cautiously. On the other hand, Chinese Premier Mao Zedong once told Prime Minister Jawaharlal Nehru that even if 300 million Chinese perished in a nuclear war, the remaining 300 million Chinese would build a new glorious civilization.[170]

India's objective is to pursue a credible deterrence and is based on punitive retaliation with nuclear weapons to inflict damage unacceptable to the aggressor. A credible deterrence against its adversaries, China and Pakistan, should not only be based on the number of nuclear weapons held but also on other factors such as political will, transparency in policy and organization, force level, and the active involvement of the military who are going to be the operators of these weapons.

Since the opening of public debate on the Indian Draft Nuclear Doctrine, a number of analysts have suggested their own assessment of the minimum number of nuclear weapons required by India in order to deter its adversaries and thereby keep a nuclear war at bay. The recommendations of responsible India analysts vary from a minimalist two dozen nuclear bombs to a maximalist figure of over 400, which is close to rival China's current arsenal.[171]

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168 Alam, "India's Nuclear Doctrine."

169 Lawrence Freedman, *Deterrence* (Polity Press, 2004), 27.

170 K. Subrahmanyam, "No More Hibakushas," *Economic Times*, June 18, 1998.

171 Kanwal, *Nuclear Defence*, 108.

The credibility of deterrence is a difficult question to answer as it reflects the psychological impact of the adversary, which is hard to gauge in advance of a crisis. Deterrence can fail because the target does not grasp the situation or is inclined to foolish interpretations.[172] The Kargil war between India and Pakistan in 1999 proved that Indian deterrence had failed as the Pakistan Army invaded the Kargil region of India despite India being a nuclear state. A number of reasons could be attributed to the failure of deterrence against Pakistan. First, Pakistani leaders assumed that possession of nuclear weapons by Pakistan would act as a counterbalance. The restraint shown by the political leadership during the Kargil war should not be construed as lack of political will as has always been understood by Pakistan. The overarching conventional superiority of the Indian armed forces over Pakistan made no sense to escalate the war in the direction of nuclear holocaust as Pakistan would have been forced to use its nuclear weapons once it started losing territory. Second, deterrence could have failed because of the lack of transparency in policy and organization as the Draft Nuclear Doctrine was formulated after the Kargil war.

To put up a credible deterrence against China, which claims the whole of Arunachal Pradesh up to Brahmaputra River in the Assam plains and rejects Indian sovereignty over Sikkim, has to be viewed seriously and with concern. [173] China has been an aggressive and expansionist country since the takeover by the communist government. Ignoring China could be viewed as "strategic procrastination" as New Delhi cannot afford another 1962 debacle. Indo-Chinese relations have deteriorated since the late 1980s, when in 1986 Chinese forces stormed the Sumdorong Chu valley of Arunachal Pradesh and it is estimated that around the same time China began to deploy tactical nuclear missiles around the Lanzhou-Chengdu regions, and it maintains three missile divisions in the area.[174]

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[172] Freedman, *Deterrence*, 28.

[173] Nair, "No More Ambiguity."

[174] W. P. S. Sindhu, "India's Nuclear Doctrine," Arms Control, Disarmament, and International Society (ACDIS), http://www.acdis.uiuc.edu/Research/S&Ps/1994-Fa/S&P_IX-1/nuclear_doctrine.html [Accessed April 19, 2006].

Looking at the intent and past history of China, it is imperative for India to put up a plausible deterrence which demonstrates the steadfastness of Indian leaders in using nuclear weapons against anybody who interferes in Indian territory. China has deployed a large number of missiles, and all the short range ballistic missiles such as CSS-2s and CSS 5s (1700 Km range) are meant for immediate neighbors,[175] and approximately 20 ICBMs are meant to deter the United States[176] For a credible deterrence against China it is also imperative that India possesses the requisite delivery systems to target any city in China. The delivery system is the most critical element in the nuclear weapons program in terms of range, reliability, operational readiness and numbers.[177] In this regard the possession of Agni III with a range of over 3000 Km or a SLBM launch capable nuclear submarine would provide the necessary credibility against China, and hence these programs should be followed up vigorously.[178]Credibility also depends on whether the weapons are deployed or not as the deployment of 20 ICBMs by China is a credible deterrence against the United States. India should consider deploying its missile forces as this act would provide credibility to its nuclear deterrence.

c. Safety of Indian Cities

In a nuclear war, the adversary is most likely to attack the large cities of India which are big industrial bases and have large population densities. Most of the developed nations like the United States, Britain, Japan, Russia and even China have underground metro railway systems in all their major cities to protect their citizens from a nuclear attack. The Indian nuclear strategy and doctrine should also look into protection of its citizens and an underground railway system seems to be the best option. India presently only has an underground metro railway system in New Delhi and Calcutta and should consider having such systems in its next 10-15 largest cities.

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[175] Kanwal, *Nuclear Defence*, 56.

[176] Ibid., 111.

[177] Jasjit Singh, "India's Credible Minimum Deterrence," IPCS, http://www.ipcs.org/IPCS-Special-Report-13.pdf [Accessed April 15, 2006].

[178]The Jewish Institute of National Security Affairs, "India Rolls out Agni III Missile," http://www.jinsa.org/articles/articles.html/function/view/categoryid/169/documentid/1880/history/3,2360,652,169,1880 [Accessed on June 3, 2006].

d. Attack on Nuclear Facilities

Clause 4.1 of the Draft Nuclear Doctrine mentions retaliation with sufficient nuclear weapons to inflict destruction … if nuclear weapons are used against India and its forces. But there is no mention about India's retaliation if a conventional attack is made on the known nuclear facilities such as CIRIUS and Dhruv nuclear reactors. For that matter, the issue will become more critical, especially during a crisis, if a conventional torpedo attack is made upon an Indian SLBM launch capable nuclear submarine as and when it joins the Fleet.

e. Designated Successors

The DND of India states that the authority to release nuclear weapons for use resides in person of the Prime Minister of India, or the designated successor(s). In the case of the United States, the government has promulgated 16 successors to the presidency and FEMA has been made the authenticating agency to confirm the legitimacy of a claiming candidate depending upon the reports received about the rest of the successors. Unlike in the American system where there is a clear chain of command should the President be incapacitated due to death, resignation or impeachment, there is no provision in the Indian constitution other than following the official protocol in order of precedence.[179] It is opined that the disclosure of the designated successors to the Prime Minister of India would remove the unnecessary speculations and rumors at the time of crisis after a successful first strike against India in which the Prime Minister is incapacitated. For that matter an agency akin to FEMA would be required in order to determine the political leader after a first strike on New Delhi, as most of the designated successors are likely to be working in the capital. Any nuclear chain of command in India needs to cater to the unique politico-military set-up in India which includes civilian leadership, bureaucrats (non-elected representatives) and military leadership. The recommended civil, bureaucratic, and military chain of command for INCCS is shown in Table 9.

[179] Alam, "India's Nuclear Doctrine."

Civilian Leadership	Bureaucratic Leadership	Military Leadership
Prime Minister	National Security Advisor	Chief of Staff Committee (COSC)
Deputy Prime Minister	Cabinet Secretary	Chief of Army, Navy or Air Force in order of their length of service if not COSC
Minister of Defense	Defense Secretary	C-in-C Strategic Force Command
Minister of Home Affairs	Home Secretary	Vice Chiefs of Army, Navy or Air Force in order of their length of service
Minister of External Affairs	Foreign Secretary	Designated Army, Navy or Air Force Officer commanding the nuclear forces
Minister of Finance	Finance Secretary	
Other Cabinet Ministers nominated at the time of Cabinet formation or at the time of their induction as Cabinet Minister	Respective Secretaries	

Table 9. Indian Nuclear Chain of Command

Table 9 provides the vertical structure in each leadership (civilian, bureaucratic and military) of the nuclear command and control chain and may or may not provide the horizontal chain of command. The civilian leadership has been chosen based on their relevance attached to the INCCS, and the Deputy Prime Minister may hold any of the portfolios in the Cabinet ministry. The vertical structure of the bureaucratic leadership may not conform to the seniority of the secretaries after the Cabinet secretary and it has been structured based on their ministries.

In spite of its inherent drawbacks of demonstrating a low credible deterrent, NFU, as per government's guidelines, will continue to drive the Indian nuclear

policy. In the land of Mahatma Gandhi the use of nuclear weapons will be denounced but measures need to be taken so as not to compromise the strategic security. The Indian nuclear doctrine is based on unshakeable NFU policy and minimum credible deterrence and these two needs to be reviewed periodically.

2. Nuclear Posture

The nuclear doctrine, policy, and posture are the circles within which a nuclear command and control system is established and is depicted in Figure 16.

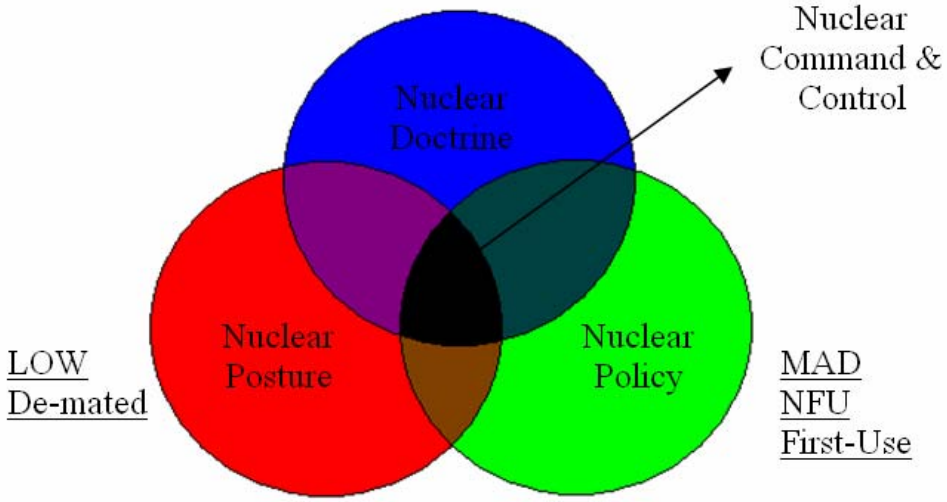

Figure 16. Establishment of Nuclear Command and Control System

The nuclear posture is a derivative of nuclear policy, which in turn is a derivative of nuclear doctrine. The nuclear command and control system is the linchpin on which the entire nuclear operation is sustained. The relationship between all these aspects is shown in Figure 17.

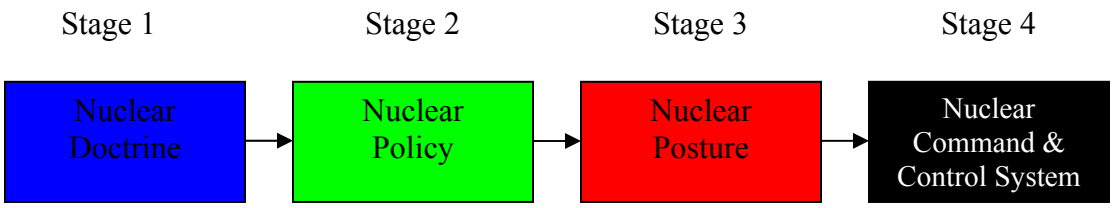

Figure 17. Formulation of Nuclear Command and Control System

There is a considerable debate in India over the establishment of stages 2 and 3 of Figure 20. At stage 2, the nuclear policy of India is hooked to NFU and a number of analysts and strategists have written about the viability of NFU in the Indian Context. Rear Admiral Raja Menon asserts that in the event that an intelligence warning of a 'definite' nuclear strike is received, the NCP will have to consider, among the other options, a first launch.[180] Another analyst, P. R. Chari, concludes that India's NFU pledge in the nuclear doctrine only make a political statement; it will not be taken seriously by anyone abroad or in India.[181] Most of these comments on the relevance of NFU in the Indian context came immediately after the promulgation of DND. Today the NFU policy has stood the test of two successive governments, both with differing ideologies. It remains clear that if India is resolute in its commitment of the NFU pledge, the nuclear posture of India then needs to grow out of that NFU policy. The current de-mated nuclear posture of India provides utmost assertive control during peacetime but the smooth transition from peacetime to crisis or after a first strike is difficult to achieve. According to Lt. General Pran Pahwa, "anyone who has functioned under time pressure and in the stressed environment of war knows that a certain amount of pre-planning, delegation of command, extensive exercises simulating various contingencies and rehearsals of drills and procedures are required to achieve the desired level of effectiveness and this can only be possible if the system is deployed in peace."[182]

[180] Menon, *A Nuclear Strategy*, 248.

[181] P. R. Chari, "India's Nuclear Doctrine: Confused Ambitions," *The Nonproliferation Review* (Fall-Winter 2000): 32.

[182] Pran Pahwa, "Command and Control of Nuclear Forces in South Asia-An Overview," http://www.indiadefence.com/nuclear_cmd_ctl.htm [Accessed July 14, 2006].

Moreover, does the de-mated posture demonstrate the "minimum credible deterrence" policy of India? It can be argued that the NFU policy in itself is quite restricting and a de-mated posture on top of it makes the "minimum credible deterrence" non-existent.

$$\text{NFU} + \text{De-mated Posture} \neq \text{Minimum Credible Deterrence} \quad (1)$$

Before deciding a nuclear posture for India which demonstrates minimum credible deterrence along with a NFU policy, one first needs to look at the options available for India. Table 10 provides all the nuclear posture options available, some of them are well defined and some are included in the study for further clarifications. However, it is pertinent to note here that the descriptions of nuclear postures mentioned in Table 10 may or may not conform to the existing nuclear postures around the world.

Nuclear Posture	Description
De-mated	The nuclear warhead comprising of core and trigger assembly are stored separately. The nuclear warhead is also stored away from delivery platforms. It is assumed that the retaliatory strike would take more than a day and depends upon the success of the first strike.
Delayed Second Strike(DSS)	The nuclear warhead i.e. core and trigger assembly are stored separately but close to the delivery platforms such that a retaliatory strike is possible within a day.
Launch After Attack (LAA)	The nuclear warhead is assembled with at least one delivery platform of the triad (ICBMs, Bombers, and SLBMs) and a retaliatory strike is possible within hours of first strike. An assembled delivery platform will act as a minimum credible deterrent.
Launch Under Attack(LUA)	The nuclear warhead is assembled with at least any two delivery platforms of the triad and a retaliatory strike are undertaken immediately after the confirmation of a nuclear detonation.
Launch On Warning (LOW)	The nuclear warhead is assembled with all the delivery platforms of the triad and a retaliatory strike is undertaken on warning of an incoming strike.

Table 10. Nuclear Postures with Descriptions

The robustness of the nuclear command and control system required and the reliance on the early warning systems increases as one proceeds from a de-mated posture to a LOW posture. The spectrum of nuclear postures that can be attained by India to fulfill its NFU policy are depicted in Figure 18.

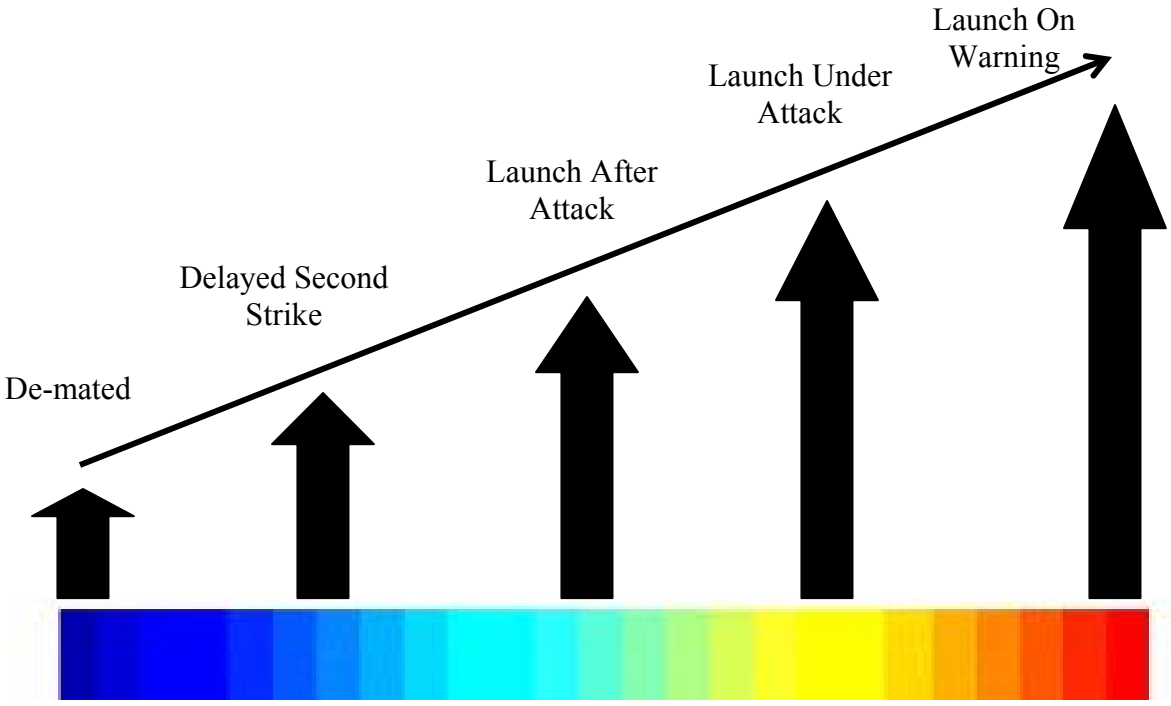

Figure 18. The spectrum of Nuclear Postures

The de-mated and the LOW postures are at the two extreme poles of the nuclear posture spectrum. Both have their own pros and cons. The pros of one end are the cons of the other end, and vice versa. The mating of warheads with delivery vehicles during times of tension faces two basic problems: first, a tendency to act speedily carries a significant risk with respect to safety, and second the adversary perceives it to be highly threatening.[183] Another problem with mating during a crisis is that it can fuel the fire of an existing crisis and things may escalate such that an adversary is tempted to launch a pre-emptive strike before the mating process. The threat perceived by India neither dictates the requirement of LOW posture nor is the threat so low that a de-mated posture would meet the requirements of "minimum credible deterrence." The LAA posture, on

[183] Basrur, *Minimum Deterrence*,46.

the other hand, is a mid-course between the de-mated and LOW nuclear posture. It demonstrate "ready" deterrence and eliminates the requirements of smooth transition from peacetime to crisis and, if required, to a nuclear war. The prerequisites of elaborate early warning systems can be dispensed with in the LAA nuclear posture. Also, the operationalization of the LAA posture would be easier to implement than the LOW posture and it will be discussed separately. Therefore, keeping the strategic threat in mind in which India is confronted by two nuclear armed neighbors and the benchmark of "minimum credible deterrence," it is recommended that the LAA nuclear posture be adopted by India. The de-mated posture is like having a car with flat tires.

NFU + LAA nuclear posture = Minimum Credible Deterrence (2)

3. Civil-Military Relations

K. Subrahmanyam, a noted Indian strategist, has stated, "it is not only inescapable that the armed forces would be involved but to project deterrence they should also be seen to be involved . . . . A minimum deterrent should demonstrate its credibility through the command and control system and the overt and publicized involvement of the armed forces... Unfortunately, in India, a large section of our political class does not understand issues like long lead times in defense preparedness. . . ".[184] Finally, it will be the military that will plan the tactics of a nuclear war and this can't be done based on scanty information. The inputs from the Indian Armed Forces with their impeccable record of professionalism should definitely be valuable by the political leaders in realizing their strategic goals.

Civil-military relations are very important in formulating the type of control (delegative vs. assertive) in a nuclear command and control system. The always/never dilemma shapes the requirements of the type of control and the outcome depends on the tilt of the civilian leadership towards the "always" or "never" dilemma. During the Cold War the tilt of U.S. civilian leadership was towards "always" and hence delegative control during most of the Cold War period in order to retaliate after a first strike or launch on warning. It is argued that the professionalism of the U.S. armed forces made

[184] K. Subrahmanyam, "Underestimating India: Project a Credible Nuclear Deterrent," *Times of India*, May 15, 2000.

the civilians accept this decision of delegative control, and in some cases "extreme delegative" such as nuclear submarines deployed with SLBMs without PALs. It is not that the Indian soldiers are not professional, but the civilian leadership has been skeptical seeing Pakistan's military intervention in domestic politics.

The civilian control pattern for INCCS needs to conform to the existing civil-military relations in India. Peter D. Feaver has suggested four patterns of civilian control and they are described below in Table 11. A fifth pattern titled "modified assertive control" is placed along with other patterns which may suit the INCCS.

	Subjective	**Assertive**	**Modified Assertive**	**Delegative**	**None**
Civilian involvement in military affairs	Very high	High	Medium	Medium	Low
Distinctness (division of labor)	Low/none	Medium	Medium	High	Low
Conflict	Low/high	High	Medium	Low	Low/high
Military involvement in civilian politics	Low	Low	None	None	Very high

Table 11. Patterns of Civilian Control

The nature of the modified assertive control can be ascertained with questions starting with what, why, when, where, and how? A few suggested examples in the form of questions, along with who is responsible for the answers, are appended in Table 12.

Application	Questions	Responsibility
Strategic	Why nuclear weapons are required?	Civilian
	What types of delivery platforms are required?	Civilian
	What are the nuclear doctrine, policy and posture?	Civilian
Operational	What is the targeting list?	Civilian and Military
	How many weapons are required?	Civilian and Military
	How nuclear operations would be conducted?	Civilian and Military
Tactical	Which aircraft is suitable for bombing?	Military
	Where should the nuclear capable aircraft or land based missiles be located?	Military
	How the training of the crew will take place?	Military

Table 12. Modified Assertive Control Examples

The above mentioned examples suggest that the division of labor can be divided into strategic, operational and tactical, with the responsibilities of strategic application being left to civilian and tactical application to the military, and operational aspects involve both civilian and military. It then emerges that in order to operationalize nuclear doctrine, policy, and posture established by civilian leaders, military involvement is not only deemed important, but is necessary.

4. Command and Control Cycle

The nuclear command and control cycle depends on the nuclear posture of a state. A bolt from the blue nuclear attack on India is unlikely from its nuclear armed neighbors. The recommended LAA posture does not place stringent demands on the early warning

systems but the surveillance systems will in any case cue the nuclear command and control cycle. The recommended command and control cycle for INCCS is depicted in Figure 19.

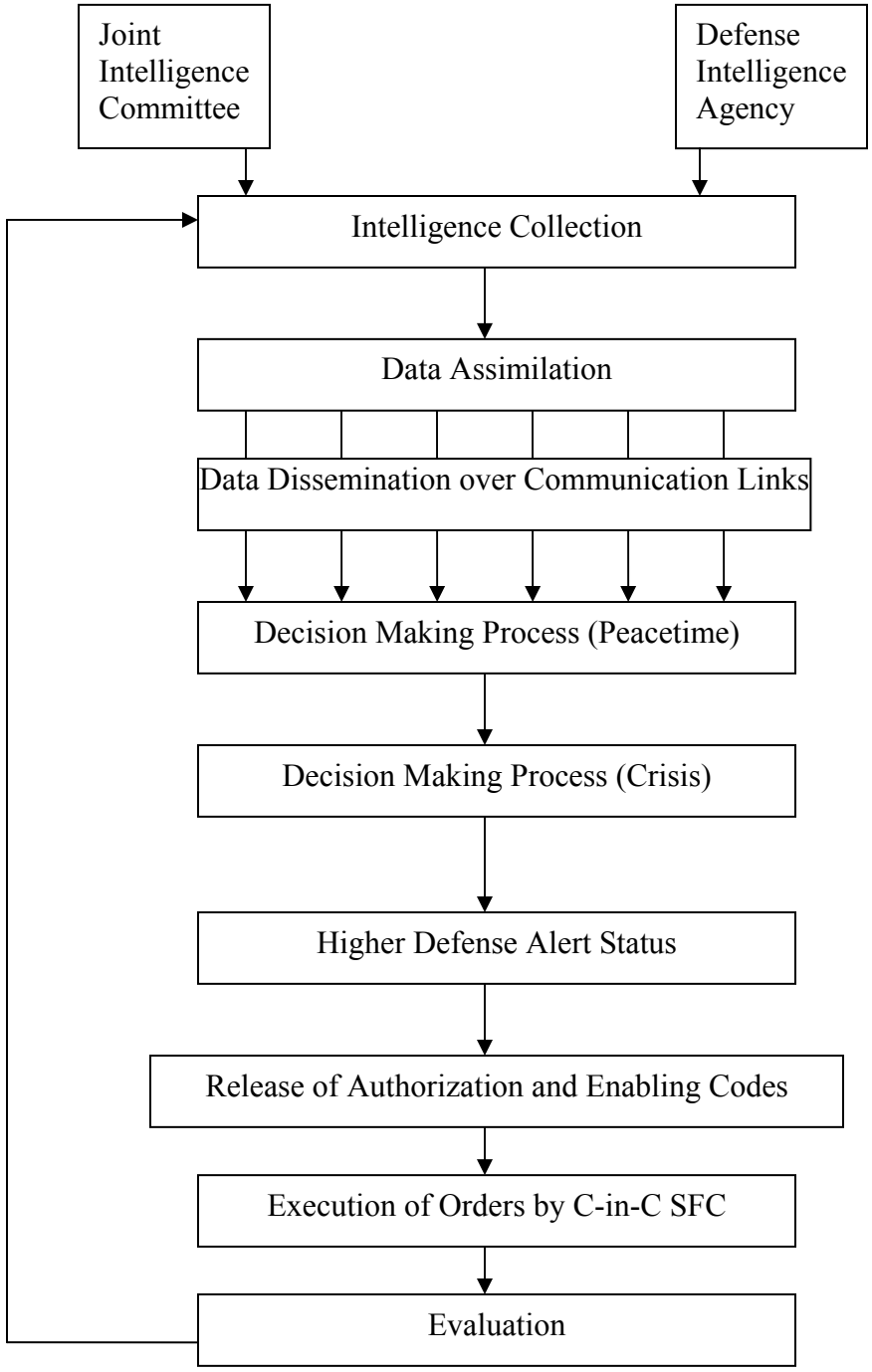

Figure 19. Recommended Command and Control Cycle

5. Nuclear Signaling and Alert Status of Nuclear Forces

The de-mated posture of India poses another problem, that of nuclear signaling ambiguities during a crisis. The challenges and complexities of nuclear signaling are analogous to the theory of deterrence where deterrence can fail because the target does not grasp the situation, or is inclined to foolish interpretations.[185] Nuclear signaling by India during the 2001-02 Indo-Pakistani border confrontation were attempted to convey clear messages, but it is not clear whether these signals were even perceived as intended by Pakistan or the other parties, and further it is not clear whether they were fully understood or even taken cognisance of, especially by Pakistan.[186] Another problem with nuclear signaling is that within a government there are many potential actors (civilian, bureaucrats and military leaders) that communicate nuclear signals, which might not represent consistency. The nuclear signals by India during the Indian and Pakistani military mobilization of 2001-02 appeared confusing, and at times were at cross-purposes with one another.[187]

The ambiguities related to nuclear signaling can not be eliminated, but with the attainment of a LAA posture some of them will cease to exist and instead of nuclear signaling, Nuclear Retaliatory Status (NRS) should be promulgated to demonstrate the escalation of a crisis. The NRS are the nuclear alert conditions meant for a retaliatory strike only and are conditions of military nuclear readiness. The recommended NRS conditions are recommended based on a LAA posture and are included in the Table 13.

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[185] Freedman, *Deterrence*, 28.

[186] Rahul Roy-Choudhuy, "Nuclear Doctrine, Declaratory Policy, and Escalation Control," The Henry L. Stimson Centre, http://www.stimson.org/southasia/pubs.cfm?ID=105&print=1 [Accessed July 15, 2006].

[187] Ibid.

NRS States	Descriptions
NRS State V	Normal peacetime condition. The manning of National Command Post (NCP), Alternate National Command Post (ANCP), Mobile National Command Post(MNCP), missiles squadrons—25 percent.
NRS State IV	Development of crisis. Manning of Posts—33 percent.
NRS State III	Crisis situation. Secondment of Air squadrons to C-in-C SFC. Manning of Posts—50 percent.
NRS State II	Conventional or limited war in progress. SLBM capable submarines (whenever available with Fleet) ready with nuclear warheads. Members of NCA in NCP, ANCP, and MNCP. Manning of Posts—100 percent.
NRS State I	Maximum force readiness. First strike eminent.

Table 13. Nuclear Retaliatory Status (NRS) States

6. Financial Implications of INCCS

The nuclear command and control system is assumed to be overly expensive as most of the deductions about the expenditure incurred on command and control are taken from the United States or the erstwhile Soviet Union. However, these deductions are misleading as every nuclear command and control system has a unique signature of a particular nuclear state. There are no hard and fast rules or any standard models for a nuclear command and control system. It all depends upon the nuclear doctrine, policy, and posture of a nuclear state. As seen in the previous chapter, 60 percent of the U.S. budget for the nuclear command and control is expended on intelligence resources (mostly early warning systems). With the envisaged INCCS, which does not include elaborate and sophisticated system such as the SBIRS and AEHF satellites of the United States, the relative cost of building INCCS within the whole nuclear operation will be much less than that of the United States. Moreover, the cost implications are not concentrated over a year or two but are spanned over several years. The utility of reconnaissance and communication satellites, Unmanned Aerial Vehicles (UAVs) and other intelligence and communication resources are not limited to nuclear operations but would also assist in non-nuclear operations. The expenditure on a nuclear command and

control system is inescapable in order to demonstrate 'true' credible deterrence. Without the necessary finance for the nuclear command and control system, it would be like having a car without fuel.

7. Measures for Negative Control

The steps taken for strengthening negative control are a mixture of organizational and technical measures which are more or less based on the U.S. system. An effective negative control will reduce the chances of unauthorized, inadvertent or accidental use of nuclear weapons.

a. Permissive Action Links

The joint statement issued by the DAE and DRDO after the Indian nuclear tests in May 1998 referred to "safety interlocks."[188] Ashley J. Tellis speculates that this could be constraining locks built into the design of the weapon itself, similar to the category A and B PALs of U.S. nuclear weapons.[189] However, it is not clear about the exact nature of the safety interlocks. India is one of the leading nations in electronic technology and it would not be long before India will be able to produce reliable PAL. The first step towards a LAA posture is to produce a foolproof PAL.

b. Personnel Reliability Program

A television channel in India claimed an Islamic militant group (Lashkar-e-Tayiba) has penetrated the Indian Air Force.[190] Though the claim was later denied by the Indian Air Force, such an event could be disastrous if it takes place in the Indian nuclear program. The personnel associated with nuclear duties should be screened and selected with the highest standards of allegiance and their conduct and behaviour should be constantly monitored and reviewed.

c. Code Management

The authenticating and enabling codes are secure as long as the code management is secure from unauthorized personnel. The code management for PALs and

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[188] *India News*, "Joint statement by Department of Atomic Energy and Defense Research and Development Organization," May16-June15, 1998, 12.

[189] Ashley J. Tellis, *India's Emerging Nuclear Posture* (Santa Monica: RAND, 2001), 433.

[190] Rediff.com, "Islamic Militants Penetrate Indian Air Force," http://news.newamericamedia.org/news/view_article.html?article_id=4a0121a91f4f17450885a091d64ff138 [Accessed Jul 23, 2006].

EAMs should be done by an agency under the supervision of the National Security Advisor. The NSA is the link between the political leader and the military, and the code management by an agency under him would additionally strengthen the negative control.

d. Two Man Rule

The two man rule in the INCCS would check and ensure that an individual who has been cleared by the Personnel Reliability Program of India can not alone launch nuclear weapons, thereby further reducing the risk of unauthorized use.

8. Measures Against Vulnerabilities

The measure against vulnerabilities can be catered by passive and active means.

a. Passive Measures

For the INCCS, passive measures against vulnerabilities would be to provide as much redundancy in the system as possible in terms of communication links, command centers, and missile squadrons (fixed and mobile). Additionally, the dispersion and concealment of missile squadrons would provide extra measures. Most of the installations in INCCS should also be hardened against nuclear attacks, especially the command centers and fixed missile silos.

b. Active Measures

It is well known that attack is the best form of defense. But the Indian nuclear policy of retaliation only forces the decision-makers to put up a formidable active defense which could strike an incoming missile. Limited resources, especially financial, make it prudent that first the punitive intent to retaliate be strengthened, and then go for active defense. In this regard the nuclear posture needs to be corrected from de-mated to LAA first, and later active defense systems should be put up for fixed installations such as command and communications centers and the fixed missile silos.

9. Command Centers

It is proposed that INCCS have three types of command centers for controlling its nuclear operations: fixed, airborne and land mobile. Current/proposed command centers along with their location and who is responsible for manning the centers is shown in Table 14.

Command Centers	Location	Manning Responsibility
National Command Post (NCP)	Around New Delhi	CIDS
Alternate National Comand Post (ANCP)	Headquarters of C-in-C SFC	C-in-C SFC
Airborne National Command Post (ABNCP)	--	C-in-C SFC
Mobile Command Posts (MCPs)	--	C-in-C SFC

Table 14. INCCS Command Centers

C. OPERATIONAL

The Chief of Integrated Defense Staff (CIDS) as the principal secretariat of COSC can be viewed as if the government is delaying the process of creating a post of Chief of Defense Staff (CDS) who would have acted as a single point military advisor to the government of India on similar lines of the post of CDS in Britain and Chairman Joint Chief of Staff (CJCS) in the United States. The post of CDS is not in the offering in the near future and the existing set up is going to remain. The two organizations under COSC (i.e., the HQIDS and SFC) should have clear demarcation of responsibilities with regard to nuclear operations. The functions of the two wings of COSC should be clearly bifurcated with HQIDS in an administrative role and SFC in an operational role in all matters relating to nuclear operations. It is recommended that CIDS assume the responsibilities of Commander USSTRATCOM and C-in-C SFC discharges the duties of any unified combatant commander of the United States.

1. Role of HQIDS

The CIDS presently heads the HQIDS and is the principal secretariat of COSC on all matters relating to management of Indian Armed Forces. This is a huge task which involves coordination of the three services in order to finally perform joint operations. The role played by the HQIDS in Indian nuclear operations is one of the many tasks in

which it is involved.[191] A healthy civil-military relation is essential in nuclear operations and an integrated and well-informed military will assist political leaders in realizing their political goals. It is recommended that a two-star officer be appointed at HQIDS as "Administrator Strategic Forces" (ASF) who would look after the administrative military aspects of nuclear operations for not only C-in-C SFC but also for the government of India. The recommended structure for HQIDS, specifically dealing with nuclear operations, is depicted in Figure 20. The main directorates under the ASF could be as follows:

- *Directorate Nuclear Policy Plans and Targeting*. This directorate would be the essential link between the C-in-C SFC and the NCA on the matters of nuclear policy, plans and targeting.
- *Directorate Inspection Team*. This directorate would consist of scientists from DAE and DRDO and the technical officers handling armament and ammunition in services. It would be looking after all the maintenance and handling aspects of all the nuclear weapons and delivery platforms.
- *Directorate Indian Defense Communication Network.* This directorate would look after all the C4I requirements of not only the SFC but also for all the services.
- *Directorate Intelligence.* This directorate would look after the intelligence gathering and dissemination to DIA. The directorate would also assist in running the proposed NCP located around New Delhi. The personnel in this directorate could come from Defense Intelligence Agency (DIA).

[191] IDS, "HQIDS Report on First year of Existence by CIDS to COSC," http://ids.nic.in/reportfirst.htm [Accessed March 30, 2006].

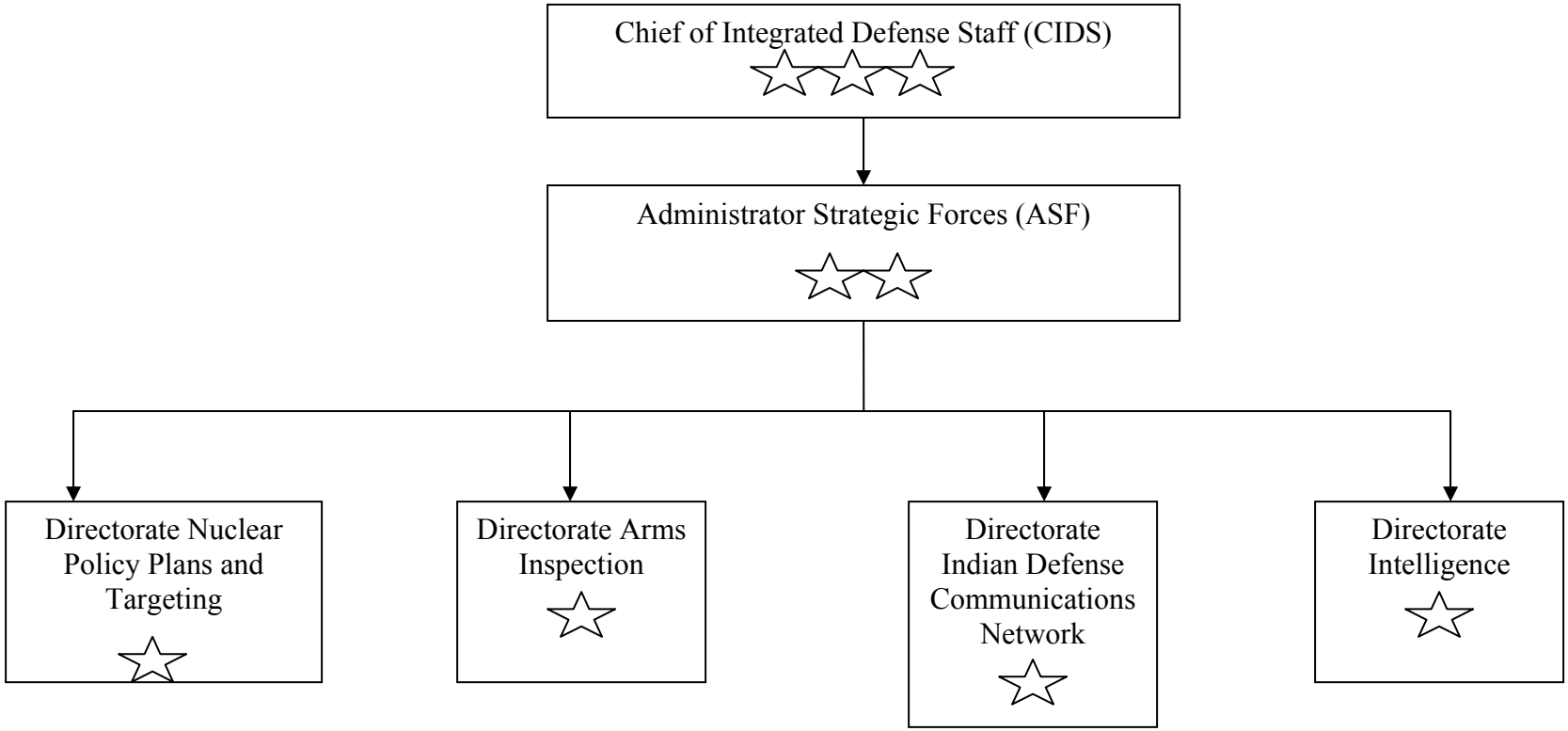

Figure 20. Recommended Structure for HQDIS

2. Role of C-in-C SFC

The role of C-in-C SFC is to manage and administer all the strategic forces of India. As an operational commander, the C-in-C SFC will be responsible for nuclear operations, intelligence gathering, training of personnel under his command, and to provide feedback to nuclear scientists of DAE and DRDO through an in-house Research and Development (R&D) unit. The recommended role, functions and responsibilities of C-in-C SFC are covered in the succeeding subparagraphs.

a. Provide Teeth and Fangs to C-in-C SFC

The LAA nuclear posture asks for at least one of the delivery platforms of the triad to have assembled nuclear weapons. The command and control of land-based nuclear missiles can provide the necessary assertive control required by civilian leaders and the land-based missiles can also be a source of credible deterrence against India's nuclear adversaries. Presently two Indian missiles, Prithvi and Agni, are suitable for such missions which can be placed under the operational control of C-in-C SFC. According to Major General Ashok Mehta (Retd.), the 333 and 334 Prithvi Missile Group under raising, along with Agni I manned by Army Artillery Corp, will become integral to SFC.[192] However, the nuclear assets under C-in-C SFC are not known to the public. R. Prasannan, a defense analyst, asks whether SFC will have its own bomber squadrons or would they be borrowed from the Air Force who would keep the warhead, the DAE or the SFC.[193] In order to accomplish the LAA posture, the operational responsibilities of C-in-C SFC could be as follows:

- Some of the Prithvi squadrons and all the Agni missile squadrons (present and future) are placed under the operational command of C-in-C SFC. The Agni missiles should have the fixed (in silos) and mobile versions, whereas the short range Prithvi missiles should only be mobile.
- The Air squadrons such as Jaguars, Mirage 2000 and Su-30 MKI should be seconded to C-in-C SFC under NRS state III. However these squadrons should come under C-in-C SFC at least two times in a year for nuclear specific training.

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[192] Ashok K. Mehta, "A Strategic Forces Command, Finally!," Rediff.com, http://www.rediff.com/news/2003/feb/10ashok.htm [Accessed July 24, 2006].

[193] Prasannan, "Not Trigger –Happy."

- The SLBM capable nuclear submarines, when available with the Fleet, should be placed under the control of C-in-C SFC in NRS state II and the channel of communications could be through the available Indian naval communication systems.
- The C-in-C SFC should provide strategic intelligence to the DIA. The intelligence gathering systems such as satellites, UAVs, radars and Signal Intelligence systems (SIGINT) which includes Electronic Intelligence (ELINT) and Communication Intelligence (COMINT) should then be placed under operational control of C-in-C SFC.

b. Operational Headquarters of C-in-C SFC

The C-in-C SFC, an operational commander, should not be stationed at New Delhi. The proposed ASF under CIDS should be located around New Delhi and should look after all the administrative requirements of C-in-C SFC with COSC and the government of India. It is recommended that C-in-C SFC be located somewhere in central India from where he can control the nuclear assets under his command in the North, North-West and North-Eastern parts of India. It is further recommended that the headquarters of C-in-C SFC be designated as ANCP.

c. Training

An operational commander of any Armed Forces around the world carries out two main tasks: warfighting and training. Since a nuclear war has never been fought there is no useful doctrine available for nuclear warfighting. The nuclear training is essential as it is required to minimize accidents and strengthen the 'always' dilemma when the weapons are employed for use. No training is complete in the military without structured classroom instructions and there is a need for establishment of a nuclear school in which personnel of SFC and scientists of DAE and DRDO are trained. It is recommended that an Indian Nuclear Weapons School (INWS) be established under the command of C-in-C SFC to train personnel of SFC and scientists of DAE and DRDO in aspects relating to handling, maintenance and usage of nuclear weapons. The INWS can also be the premier institute for R&D in nuclear weapons.

d. Organization of SFC

The recommended organization of SFC under an officer of the rank of Lieutenant General and equivalent is depicted in Figure 21. The main directorates under C-in-C SFC could be as follows:

- *Directorate Operations*. This directorate would look after the day-to-day nuclear operations of Prithvi, Agni and Air squadrons of India.
- *Directorate Intelligence*. This directorate would be involved in strategic intelligence and would have sub-directorates of UAV, satellite, Human Intelligence (HUMINT), Measurement intelligence (MASINT), radar and SIGINT.
- *Directorate Arms Inspection*. This directorate would be looking after maintenance and handling aspects of all the nuclear weapons and delivery platforms.
- *Directorate Technical*. This directorate would look after the maintenance and handling aspects of all C4I2 assets under C-in-C SFC.
- *Directorate Training*. This directorate would look after the training of personnel of SFC and scientists of DAE and DRDO. The proposed INWS could come under this directorate.

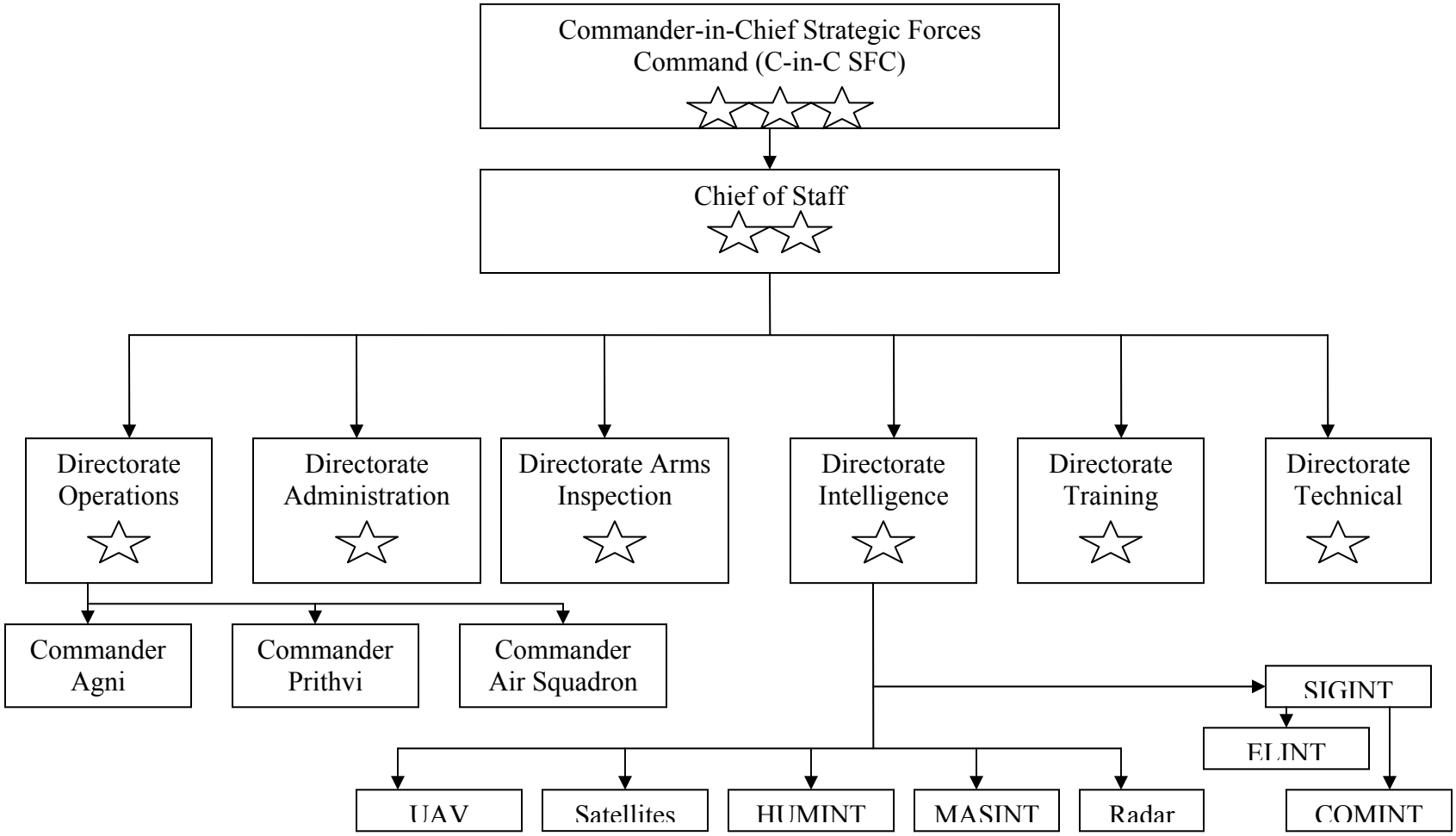

Figure 21. Recommended Organization of SFC

D. TECHNICAL

The technical aids for INCCS are envisaged in the DND which range from command, control, communications, computing, intelligence and information (C4I2) systems to space based and other assets to provide early warning, communications and damage assessment. The digital technology has rapidly changed the way wars are fought today. The rapid growth of digital technology requires an organization at a national level which has a joint vision for all three services of India. In the United States, the Defense Information Systems Agency (DISA) is a combat support agency responsible for planning, engineering, acquiring, fielding, and supporting global net-centric solutions to serve the needs of the President, Vice President, the Secretary of Defense, and other DoD Components, under all conditions of peace and war.[194] The core mission areas of DISA are: communications, combat support computing, information assurance, joint command and control, and joint interoperability support. In India there is a need for an organization similar to DISA to look after the requirements of the Indian defense ministry. It is therefore recommended that a civilian organization under DRDO be established as Indian Defense Information Systems (IDIS) to plan, field, and maintain an integrated C4I2 system that would serve the Armed Forces of India. The C4I2 system planned under IDIS for strategic forces should cater to three main and essential tasks: to provide intelligence to NCA to make decisions, to provide command centers the necessary communication links, computers, command and control decision aids, and to provide redundant capabilities to communicate the orders from NCA to C-in-C SFC and his subordinate commanders. Apart from the requirements of a C4I2 system and space based systems which are envisaged in the DND for command and control of nuclear forces of India, additionally PALs would also be required to fulfill the demands of LAA nuclear posture. The technical aspects of INCCS are mentioned in the succeeding paragraphs.

1. C4I2 Systems

The C4I2 systems are essential for today's battle space management. The data fusion, filteration and dissemination are main functions of a C4I2 system. The need for an effective command, control, communication, computer, intelligence and interoperable

[194] Defense Information Systems Agency, "About DISA," http://www.disa.mil/main/about/missman.html [Accessed July 17, 2006].

system (C4I2) has been felt and a Data Fusion Centre (DFC), a module of national C4I2, is being conceptualized to function as the decision support system for the National Command Authority at the National Command Post (NCP).[195] The communication systems in the C4I2 framework are the bedrock on which the effectiveness of the C4I2 system is ascertained. The communication links for nuclear operations should be based on a wide variety of communication systems including optical fiber lines, troposcatter, radio and satellites to provide redundancy. The Indian Army has embarked on a fully automated communication network for its field forces and termed it as Army Radio Engineering Network (AREN), whereas the Indian Air Force has planned for a dedicated communication network for its air defense under Air Defense Ground Environment System (ADGES).[196] The AREN and ADGES systems should also be integrated with the proposed NCP and ANCP in order to control the nuclear assets under C-in-C SFC. Additionally, mobile command and communication centers should be operated by C-in-C SFC. The future nuclear submarines capable of launching SLBMs should be controlled through available communication channels of the Indian Navy. Before the SLBM capable submarine joins the Fleet, a redundant system in the form of TACAMO system should be checked for reliability of communications with a submerged submarine.

The requirements of elaborate intelligence systems do not exist in view of the short flight time of an incoming missile from India's nuclear armed neighbors. However, intelligence systems such as satellites which could provide imagery and UAVs for reconnaissance are absolutely essential for monitoring and promulgation of forewarning.

2. Space Based Assets

The space based assets in the INCCS could be tasked for two main functions: communications and reconnaissance. The communications should be made available in the form of data as well as voice. The satellite based reconnaissance would provide early warning as well as damage assessment after a nuclear detonation. There is no dedicated defense satellite and INSAT series of satellites do meet some of the requirements of

[195] IDS, "HQIDS Report."

[196] Anand, "Joint Development."

defense communications.[197] For the space based surveillance, India launched Technology Experiment Satellites (TES) in 2001, which has a high resolution camera with a resolution of one meter. The images beamed by TES are analyzed by defense Image processing and Application Center (DIPAC), which is manned by personnel from the three services.[198]

The INCCS requirement in the space segment is a constellation of satellites which could have communication and surveillance payloads. These payloads are not INCCS specific and could also be used during a conventional war or during peacetime military operations. The military satellites differ from the commercial satellites in four aspects: military satellites should additionally employ encryption, be nuclear hardened, have better resolution and have anti-jamming capabilities. It has been deduced by the Indian strategic planners that the country would require a constellation of approximately six dedicated surveillance satellites if New Delhi seeks to observe the status of critical facilities and formations in China and Pakistan twice or thrice daily.[199] A set of dedicated military satellites will give the Armed Forces of India a significant edge and will be a force multiplier with respect to early warning, surveillance, reconnaissance, and communications.

3. PALs

The PALs are essential for INCCS as they establish the necessary negative control required by civilian leadership for the deployed nuclear weapons. The achievement of India toward attainment of PAL technology is not known.

E. SECONDARY EMPLOYMENT OF NUCLEAR COMMAND AND CONTROL SYSTEM

The command and control facilities recommended for INCCS have secondary uses. The system under INCCS has robust communication facilities and provides an excellent command platform for decision-making which could be utilized in non-nuclear roles. The secondary roles of INCCS are mentioned below:

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[197] Anand, "Joint Development."

[198] *Hindustan Times*, "India to Launch series of Spy Satellites," February 13, 2002.

[199] *The Hindu*, "Spy Satellite Launch by Year –End," July 2, 2000.

- The facilities of INCCS could be used in joint military operations or during a conventional or limited war.
- With the help of NCP civilian leadership at New Delhi, whenever it desires, can monitor the military operations in India including the operations against terrorists.
- The INCCS could be used in major natural disaster such as tsunami, earthquake, floods, cyclones, etc. The management during these times could be regulated using the INCCS.

G. COOPERATION WITH THE UNITED STATES

On March 2, 2006, President George W. Bush and Indian Prime Minister Manmohan Singh announced an initiative to develop a strategic global partnership between the United States and India. The initiative states that the United States and India are "building the foundation of a durable defense relationship that will continue to support [their] common strategic and security interest."[200] The most significant aspect of President Bush's strategic global partnership with India is his proposal to normalize nuclear cooperation. This strategic partnership is expected to blossom in the years to come. The cooperation with the United States for the development of INCCS can be extended in two fields.

First, the assistance from the United States in developing PALs would help India in strengthening its negative control over nuclear weapons and reduce the danger of unauthorized use. The United States shared detailed information about PAL design with the British, apparently in an attempt to encourage such devices in Britain's independent arsenal, and made similar overtures to France.[201] This kind of assistance is not possible by the United States within the purview of Non Proliferation Treaty (NPT). But if the rules of NPT are interpreted such that the development of PALs would absolve the requirement of testing Indian PAL, thereby India could stick to its moratorium on further nuclear tests. It is pertinent to note here that PALs are weapon specific and no country

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[200] The White House, "Fact Sheet: United States and India: Strategic Partnership," http://www.whitehouse.gov/news/releases/2006/03/print/20060302-13.html [Accessed June 5, 2006].

[201] Shaun Gregory, "The Command and Control of British Nuclear Weapons," (Peace Research Report no. 13, University of Bradford, December 1986), 24; and Richard Ullman, "The Covert French Connection," *Foreign Policy*, no.75 (Summer 1989): 13-16.

would like to divulge this information. In this regard, Indian scientists can be trained in the U.S. on the general aspects of PALs and later these scientists can figure out specific PALs for Indian nuclear weapons.

Second, the United States, during their annual exercises (code named MALABAR), along with the Indian Navy can transmit VLF messages using their TACAMO aircraft to Indian submarines to see the efficacy of the TACAMO VLF system. If the exercise goes well, maybe India could buy TACAMO aircraft or build one with U.S. assistance for India's future nuclear submarines.

H. CONCLUSION

The nuclear command and control system of a country is based on its nuclear doctrine, policy and posture. The nuclear doctrine, policy and posture provide the necessary guidance for building each block of the command and control system. The Draft Nuclear Doctrine of India promulgates the policies of NFU and minimum credible deterrence and the nuclear posture of de-mated. It can be argued that NFU and de-mated posture does not correspond to minimum credible deterrence against nuclear armed neighbors of India. The mating of nuclear weapons during a crisis poses many problems, including safety risks, and is more de-stabilizing as the adversary perceives it as highly threatening.

The recommended LAA nuclear posture of India with a ready use delivery platform in the form of land based missiles will act as a 'true' credible deterrent against Pakistan and China. The shift of the nuclear posture of India from de-mated to LAA would ask for active involvement of the Indian Armed Forces and technical and organizational measures to strengthen negative control. The proposed ASF under CIDS should look after the administrative needs of C-in-C SFC and government of India. It is recommended that the C-in-C SFC, an operational commander of nuclear forces, should be based away from New Delhi and Prithvi and Agni squadrons be placed under his operational command. In order to implement the LAA posture, new C4I2 systems would have to complement the existing systems and satellite based assets will be required for communications and reconnaissance.

The proposed INCCS would also supplement the non-nuclear operations and assist the national leaders during national disasters. Cooperation with the United States should be sought for development of PALs and a TACAMO system which would assist INCCS in strengthening negative control and in building a robust command and control system for Indian nuclear submarines.

V. RECOMMENDATIONS AND CONCLUSIONS

A. INTRODUCTION

India became a nuclear weapon state on May 11, 1998 after detonating a series of nuclear devices in Pokhran. The overt demonstration of nuclear weapons capabilities has highlighted the promulgation of nuclear doctrine, policy, posture and eventually the nuclear command and control in the forefront of affairs. The formulation of NSAB and its recommendations on nuclear doctrine in the form of DND, and acceptance of DND by CCS on January 4, 2003, established the necessary foundation for nuclear operations in India. The nuclear policies of NFU and the "minimum credible deterrence" are the origin as well as the end product of nuclear operations in India. The nuclear posture which is the intermediate product between the foundation and the end product is dictated by threat, civil-military relations, technology available and the necessary budget available for carrying out the nuclear operations. The command and control of nuclear weapons is a derivative of nuclear posture which links the strategic requirements of civilian leadership to the operational aspects of the military. It is a link which connects the strategic concept to the nuclear weapons. If the nuclear command and control link is not there or is broken then the strategic concept and the nuclear weapons have no meaning in itself.

The strategic culture of a country hardly changes as is evident in India's case where it has denounced nuclear weapons since its independence. The strategic security concerns had forced India to demonstrate its nuclear capabilities, but then the strategic culture of India played its role in still denouncing the weapons as India adopted the policy of NFU. The nuclear posture requires a periodic review in order to apply the necessary changes to the nuclear command and control system.

B. SUMMARY OF FINDINGS

1. Adherence to NFU

India is determined to abide by its NFU policy and will follow it to the letter and spirit whether or not a bilateral or multilateral deal on NFU is achieved with Pakistan or China. It can be argued that NFU policy and retaliatory strike only of India may not

necessarily demonstrate the required deterrence, especially against China which has far more superior nuclear forces and missiles. It is well understood that a weaker side is unlikely to assume a nuclear policy of NFU, but the discard of nuclear weapons use and the notion that they are not meant for war fighting determines the essence of the strategic culture of India. Nuclear policies are not country specific and are solely dependent on the strategic culture of a nation. The NFU policy of India marks its intent to maintain strategic stability in the region by sending out signals to both its adversaries to follow the path of restraint. Pakistan's concept of first use against India when it is engaged in domestic destabilization of Pakistan is ironical as it is Pakistan who is involved in domestic destabilization of India, however India has not responded with a similar first use threat.

2. Minimum Credible Deterrence and Nuclear Posture

The "minimum credible deterrence" is country specific as deterrence can be evaluated differently by different countries. Therefore, what it takes to deter China will not be similar to what it takes to deter Pakistan. The deterrence against China is not only weak because of inferiority of nuclear forces of India in terms of quality and quantity, but also due to the fact that India can not target many main cities in China including Beijing[202]. Once "minimum credible deterrence" against China and Pakistan has been ascertained then a commensurate nuclear posture should be formulated. Again, a de-mated posture might be viable against Pakistan but whether or not it poses a credible deterrence against China is difficult to gauge. The mating of weapons during a crisis is a destabilizing factor as an adversary can perceive it to be threatening and might be tempted to launch a pre-emptive strike.

3. Important Aspects of the U.S. Nuclear Command and Control System

The United States has been carrying out nuclear operations for more than six decades and has established a robust nuclear command and control system. Important deductions from the United States nuclear operations are as follows:

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[202] W. P. S. Sidhu, "A Languid but Lethal Arms Race," United Nations Institute for Disarmament Research, http://www.unidir.org/pdf/articles/pdf-art2115.pdf#search=%22India%20can%20not%20target%20Chinese%20cities%20including%20Beijing%2CJasjit%20Singh%20%22 [Accessed September 1, 2006].

- The movement of supreme authority and its designate successors authorized to release nuclear weapons are monitored by a central agency at all times so that during a crisis after the first strike the country is not bereft of political leadership.
- The NPR 2001 posits the integration of nuclear capabilities with conventional strike capabilities. The concept is to deter those countries which do not possess nuclear weapons as the credibility of the United States using nuclear weapons against non-nuclear rogue states is weak.
- The LOW posture is extremely demanding on the early warning systems and is fraught with false alarms.
- Elaborate redundancy is maintained in the command centers which are land based, airborne, and mobile.
- Elaborate redundancy is maintained in communication links with main thrust on satellite communications. For submarine communications, the entire world is covered with an ELF station in the United States and as many as nine VLF/LF stations worldwide.
- The negative control over United States nuclear operations is strengthened through PALs, PRP, two-man rule, and through efficient code-management of authenticating and enabling codes for the nuclear weapons.
- The United States command and control system vulnerabilities are overcome through EMP hardening of systems, promulgation and tracking the movements of president and his successors, and through active and passive defenses against physical destruction.
- The financial implication of a nuclear command and control system in the nuclear operation amounts to nineteen percent, and sixty percent of it goes to intelligence gathering systems.

4. Civil-Military Relations in India

The civil-military relations define the nature of a nuclear command and control system, i.e., delegative or assertive. The civil-military relations in India are unique from rest of the world. Former Army Chief of Staff, General V. P. Malik, sums up the position of the armed forces in strategic aspects. According to him, "the armed forces of India are kept out of the national security loop and were not adequately consulted by the government on operational and strategic matters."[203] The non-involvement of the

[203] Bedi, "A Credible Nuclear Deterrent."

professional military of India on all aspects of strategic concern devoid the decision making process of a necessary and valuable input.

5. Absence of a Common Communications Backbone

Any future military operations require joint effort, and thus reliable joint communications will play an important role toward accomplishing the assigned tasks. Similarly, nuclear operations are not conducted in isolation and unity in efforts will be the hallmark for successful and accident free operations. The lack of joint architecture of command, control, and communications system in the defense forces of India[204] would be a set-back to nuclear operations.

C. RECOMMENDATIONS AND ROADMAP FOR INDIAN NUCLEAR COMMAND AND CONTROL SYSTEM

1. LAA Nuclear Posture

Nuclear posture is an important criterion in determining the credibility of deterrence. The de-mated nuclear posture of India is easy to maintain during peacetime but poses challenging tasks during transition from peacetime to crisis in the form of potential ambiguities in nuclear signaling about the intent, raises questions about safety because of hurried nuclear operations, creates more instability in the crisis when the adversary is aware of possible mating of nuclear weapons, and the inherent problems associated with the coordination of mating when three different organizations are involved (military, DAE, and DRDO). Apart from these challenges the de-mated posture does not display a credible deterrence against India's adversaries. It is presumed that the ready use nuclear arsenal of China will force the United States to work cautiously over a crisis involving Taiwan. Similarly, the intent to retaliate is best demonstrated when India deploys its nuclear weapons in the LAA posture with mated land based ballistic missiles. The limited war doctrine suitably applies to an inferior Pakistan and there is no other option left for India in order to dissuade Pakistan from creating domestic instability in India. The "minimum credible deterrence" against China and Pakistan is depicted in Figure 22. It is recommended that Indian nuclear posture be evolved around the LAA

[204] Anand, "Joint Development."

posture with ready-use nuclear armed land-based ballistic missiles in order to demonstrate "minimum credible deterrence" as stipulated in the DND.

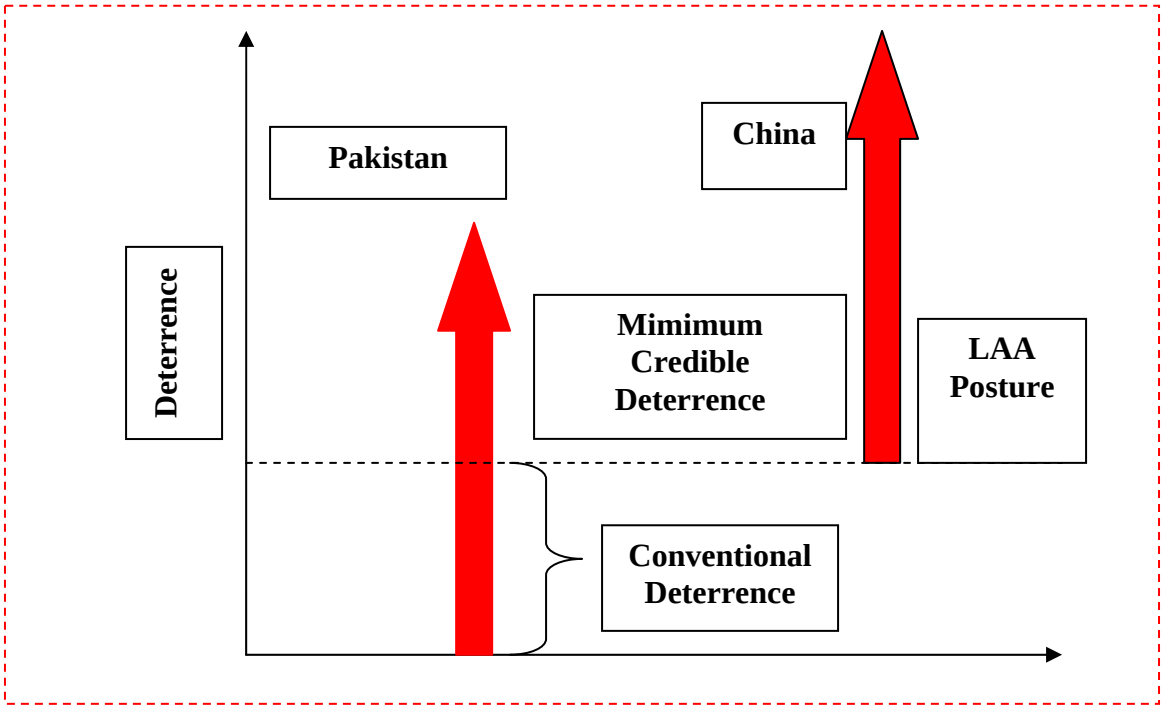

Figure 22. Minimum credible Deterrence against China and Pakistan

2. Division of Labor in Civil-Military Relations

The civil-military relations in the LAA posture move toward integrating the Indian Armed Forces into the decision-making process relating to strategic aspects of India. Whether the nuclear weapons are deployed or not, eventually the military will be involved as it will be the military who will execute the orders. According to Rear Admiral Raja Menon (Retd.), there is no organization other than the armed forces that could be trusted with the nuclear weapons, but at the same time the politicians, used as he is to his own standards of morality, is unsure of the consequences of handing over the weapons to the services.[205] The armed forces of India are a professional force and have

[205] Menon, *A Nuclear Strategy*, 261.

discharged their duties responsibly and with the utmost dedication. In a democracy, what matters most in civil-military relations is the division of labor. Once the division of labor has been demarcated then half of the conflicts are solved before they erupt. It is recommended that for nuclear operations in India the division of labor be segregated into strategic, operational, and tactical. The strategic element will be totally under the domain of politicians and tactical under the purview of military leaders. The operational element requires joint understanding between the political and military leaders so as to make the strategic element formulated by the civilian leaders transform into the tactical element pursued by the military.

3. Operational Assets of C-in-C SFC

The C-in-C SFC should have certain operational assets in order to demonstrate its operational capabilities. The secondment of missiles and air squadrons will have the problems associated with equipment which are placed under operational control of a commander for a short duration. These problems include administrative, maintenance, command and control, and training. It is recommended that C-in-C SFC be operationally responsible for all the nuclear armed short range and ballistic missiles of India. The C-in-C SFC should also have under his command the intelligence gathering systems such as satellites, UAVs, radars, ELINT and COMINT systems so that he can assess the strategic situation and report appropriately to his higher commands. The operational headquarters of C-in-C SFC should be located somewhere in central India from where he could control the operational assets placed under his command.

4. Technical Aspects of Command and Control

In order to deploy a ready use nuclear arsenal in the LAA posture, the first and foremost capability which is required in the Indian context is the manufacture of PALs. The C4I2 systems and the space based assets will provide necessary support in the decision-making process by providing early warning, surveillance, reconnaissance and communications.

5. Command Centers

It is recommended that a hardened NCP be located around New Delhi with the manning responsibility entrusted with CIDS and the ANCP be the headquarters of C-in-C

SFC. In addition, ABNCP and MCPs should be procured or manufactured and placed under the command of C-in-C SFC.

6. Negative Control

The negative control of nuclear operations is strengthened by using PALs, PRP, two-man rule and through efficient code-management of authenticating and enabling codes.

7. Alert Status of Nuclear Forces

It is recommended that alert status of nuclear forces be signaled through attainment of NRS. This way some of the present ambiguities related with nuclear signaling can be eliminated.

8. Roadmap for INCCS

The nuclear command and control system of a nuclear weapon state takes time to fully emerge as a robust system. The roadmap for INCCS can be divided into short-term, mid-term, and long-term goals. The events associated with the roadmap of INCCS are shown in Table 14.

Short-term (Up to 3 years)	Mid-term (3-5 years)	Long-term (over 5 years)
Promulgation of successor(s) to Prime Minister	Deployment of Land based missiles in LAA posture	Development of Anti Missile Defense
Identify location and infrastructure for C-in-C SFC and ASF	Dedicated military satellites	
Creation of NCP, ANCP and mobile canters	Joint C4I2 system for the three services	
Manufacture of PALs		
Training of Air squadrons with C-in-C SFC		

Table 15 Roadmap for INCCS

D. CONCLUSION

The nuclear command and control system links the strategic concepts of a country to the nuclear weapons. Neither the strategic concepts nor the nuclear weapons themselves demonstrate deterrence, but it is demonstrated by the nuclear posture permeated through the nuclear command and control system. The nuclear command and control system of India is evolving cautiously to fulfill the requirements of DND. The LOW posture is certainly not the option for India as the short flight time of the missiles from the adversaries leave very little time for a LOW retaliation. The current de-mated posture is suitable for an inferior Pakistan but the credibility of deterrence is doubtful against China. The deployment of nuclear weapons in the LAA posture with nuclear armed ballistic missiles ready for use would definitely deter China in any future conflict. The intent to retaliate with a handful of nuclear capable missiles in the LAA posture will be the "minimum credible deterrence" against China. The intent and waging of a limited war should dissuade Pakistan from domestically destabilizing India, leaving the nuclear deterrence in the background for any imprudent act from Pakistan.

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   Naval Postgraduate School
   Monterey, California

3. Chairman
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4. Dr. Peter Lavoy
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5. Professor David Jenn
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6. Commodore P Murugesan
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7. Lt CDR Rakesh Kumar
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